Mariners Weather Log

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NDBC Installs Mesoscale Buoy Network for '96 Olympics

Eric A. Meindl
Chief, NDBC Data Systems Division

The National Data Buoy Center (NDBC) of the National Weather Service (NWS) installed and is operating three moored data buoys in the vicinity of Savannah, Georgia, specifically to support the 1996 Olympic regatta events [to be held from July 22 through August 1-Ed.]. The three buoys, identified as stations 41021, 41022, and 41023 (Figure 1), are standard 3-m discus buoy hulls (Figure 2, Page 8) held in place by shallow, all-chain moorings. Each buoy is equipped with two anemometers, two barometers, an air-temperature sensor, a water-temperature sensor, and an accelerometer for determining sea state. Stations 41021 and 41022 also are outfitted with a current meter for measuring the direction and speed of the current at 1.5-m depth.

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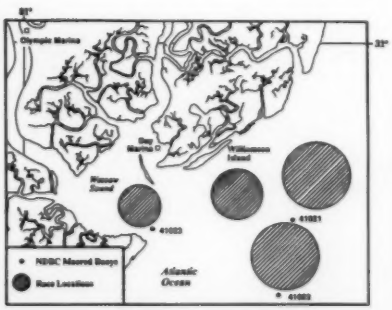

Figure 1. Site of Olympic Regatta on the Georgia coast, showing location of special NDBC buoys.

National Weather Service Modernization

Improved Weather Services for Coastal Areas and Maritime Interests

Paul A. Jacobs
Manager, Marine Weather Services
Office of Meteorology
National Weather Service

Introduction

The National Weather Service (NWS) is making the most ambitious change in its 125-year history. New technologies are going into operation, and services are being reorganized that are expected to bring major improvements in weather warnings and forecasts for the American public, including the nation's maritime community. Technological advances are happening in four major areas: weather radar, surface weather observing, weather satellites, and information processing and communications.

New Technology

Forty-year-old weather surveillance radars are being replaced by new radar systems. The old radars only display reflected echoes of precipitation patterns and coarse estimates of storm intensity and vertical extent. The new radars are based on the Doppler principle (named after the scientist who discovered it) in which transmitted radio waves change frequency when reflected from a moving target. Doppler weather radars, called the WSR-88D, measure internal storm structure in fine detail and calculate the wind field within the storm. In addition, the radars can detect wind patterns in clear air by reflection of the radio waves from suspended particles such as aerosols, dust, and insects. The radar's capabilities make it possible to detect the conditions that lead to severe storm formation. This helps to increase the lead time and accuracy of severe weather and flash flood warnings. In summary, comparing the WSR-88D to the older radar is like comparing a CAT-scan to an X-ray.

The NWS is installing 120 WSR-88D Doppler radars around the country. Doppler radars, also being installed by the military and the FAA, will support NWS operations in certain areas of the lower 48 states and in Puerto Rico, Alaska, Hawaii, and Guam.

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From the Editor

Allow me to introduce myself. My name is John Oscanyan. My wife, Mary Ann, and I run WordWeavers, a desktop publishing and document archiving company in Germantown, Maryland. While my wife and I are not meteorologists, we do keep a boat on the Chesapeake Bay, and therefore have more than a passing interest in the goings on of the weather.

When we were originally contacted by Martin Baron to see if we would be interested in taking over the production of the Mariner's Weather Log (MWL), we were unfamiliar with the magazine. Marty gave us a couple of back issues to get the feel of what had been done and what would be expected. We looked over those issues first with a "productionist's eye," trying to get a feel for what we would be doing. From time to time we would glance through an issue, trying to catch anything of interest from the standpoint of putting the magazine together. After a week or so, I found myself with the time to actually read one of the articles. I found it to be very interesting and informative. From there on I was hooked. I not only read that issue cover to cover, but the other issues Marty had left with us as well. I began to remember things I had learned in school regarding the weather. As a lay reader, it was interesting to find out how the weather information got where it had to go. While I had always realized the immense effect of the world's oceans on the weather, I did not know the vast amount of effort that went into gathering all the relevant data, not to mention transmitting, correlating, interpreting, and disseminating that data in a useable form. This, it seemed to me, was the duty of the MWL.

Mary Ann and I did, however, come across one thing about the MWL that we would like to change. We found that some information reported in the MWL, while impressive in it's scope, was difficult to grasp by the layman without the benefit of higher education in the interpretation of that data. We proposed the introduction of more articles on the understanding of the information we were reporting, as well as some other information on the oceans in general. Marty agreed, and that became our guiding principle. While maintaining the technical side of the MWL, we would also attempt to broaden its appeal. Therefore, you will notice a couple of new areas being reported on in this issue, such as those covering marine biology and physical oceanography. I think everyone will benefit from widening the range of information included in the MWL. In future issues I hope to run articles explaining, in lay language, the information presented in some of the more technical reports.

Another change you will notice is the format. We're starting out with a newsletter format and are unsure whether we will return to a magazine format. Perhaps a few of you loyal readers would be kind enough to drop me a line (no pun intended) indicating your feelings on this subject.

In order to get the MWL back on schedule, the cutoff for submission of articles for the next issue will be July 15. Please be sure to submit your articles to me at the mailing address, fax, or e-mail address listed at the left. Thank you for your contributions!

Well, that's about all I have for now. Please feel free to drop us a note if you have a comment or suggestion. Constructive criticism is always welcome. After all, we are the new guys around here!

John Oscanyan⚓

This is the first issue of the Mariners Weather Log produced by the NWS since 1966, when a re-organization transferred it from the U.S. Weather Bureau (USWB) to the Environmental Science Services Administration's National Oceanographic Data Center (NODC). The Log began as a USWB publication in 1957. We thank the NODC, especially editors Richard DeAngelis and Elwyn Wilson (prior to 1982), and their assistants, for doing an outstanding job over the years.

As an NWS product, the MWL's focus will continue to be marine and coastal meteorology, storms at sea, forecasting, and related subjects. However, there will now be a greater emphasis on operational NWS marine programs and activities. Thus, regular columns from the Tropical Prediction Center and the Marine Prediction Center will highlight NWS forecast operations over vast areas of the Atlantic and Pacific oceans, including the Gulf of Mexico and Caribbean Sea. A Coastal Forecast Office column is being added to describe the marine programs of stateside NWS forecast offices. Some columns from the past have been retained, others are completely new.⚓

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NWS Modernization

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Figure 1 shows the radar locations and the areas of coverage in the lower 48 states.

A major part of weather forecasting is the taking and reporting of weather observations from 1200 locations around the country. Observations have been taken by personnel in the NWS, FAA, and the military. However, the issuance of a warning to save lives and property can delay an important weather observation. The Automated Surface Observing System (ASOS) solves this problem by allowing people to devote more time and expertise to the service aspects of NWS programs without interrupting the weather observing function.

The first two of a new series of geostationary satellites have been launched to replace a satellite over the Atlantic that had failed and the Pacific satellite that was operating on "borrowed time." The new satellites can take four pictures every 30 minutes compared with the earlier generation's one picture per half hour. The imagery has much finer detail for storm analysis. The satellites include improved infrared sensors for severe weather investigation to complement the data measured by the Doppler radar. Also included are sensors that probe the atmosphere's temperature and moisture in the vertical even while the imagery is being taken. These "soundings" provide critical data to help in analyzing and predicting storm intensification or improvement.

Warnings and forecasts issued by NWS field offices are prepared on an outmoded computer system based on technology of the 1970s. It now has limited capability for data collection, processing, and display. Many new requirements over the years had to be met by "hanging" various types of personal computers onto the system. It will be replaced by the Advanced Weather Information Processing System (AWIPS), supported by high-speed, satellite communications. AWIPS workstations will process substantially more data faster, will run a variety of programs to automate the preparation and issuance of warnings and forecasts, and will display weather maps, satellite imagery, and Doppler radar data on a single system. As is the case with the ASOS system, AWIPS will relieve the meteorologist from many time consuming manual tasks, such as data gathering and typing forecasts from scratch, allowing him or her to concentrate on analyzing and predicting the weather and keeping people informed.

Other new technologies include new NOAA Weather Radio recording consoles for greater flexibility in broadcast programming and improved warning dissemination; next generation mainframe computers and new workstations at the National Centers for Environmental Prediction for faster processing of complex atmospheric and air-sea prediction models; and wind profilers to measure the vertical distribution of winds above the earth's surface more frequently and efficiently than by balloon-borne soundings.

Figure 1
WSR-88D (NEXRAD) Doppler Radar Sites
and effective coverage

Restructured NWS Field Operations

To get the most benefit from these new technologies, the NWS field organization will be restructured from the present 52 Weather Service Forecast Offices and 197 smaller Weather Service Offices to a network of **119 Weather Forecast Offices (WFOs)**. Instead of operating two types of field offices, with different staffs and levels of training, issuing different products for the same weather event, the NWS is creating a uniform network of professionally staffed WFOs based on the surveillance area of each Doppler radar and all other surface, upper air, and satellite data within the radar's area of coverage. This plan will result in equivalent capabilities among the NWS field offices and more uniform weather services to the public and the marine community.

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NWS Modernization

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Marine Weather Services

What does NWS modernization and restructuring mean for the coastal marine environment? **Forty-three (43) of the 119 WFOs will provide warning, forecast, data, and information services to the coastal population and recreational, commercial, and scientific maritime interests.** This is an increase of 19 offices over the number providing marine weather services today. Thirty-three (33) of the WFOs will be located along, and provide services for, the oceanic coastlines, including Hawaii, Puerto Rico and Guam. Ten (10) WFOs will serve the Great Lakes. These changes in field office operations, together with the technological capabilities described above, will allow NWS to redistribute geographic areas for improved marine warnings and forecasts.

The marine warning and forecast program consisting of Coastal, Offshore, and High Seas services will be modified into a two-tiered structure:

Coastal Areas Out to 100 nm—Coastal forecast areas, which now vary from 20 to 60 nautical miles (nm) seaward (depending on coastal region), will be redesigned into uniform areas extending out to approximately 100 nm and realigned at new coastal landmarks to take the fullest advantage of Doppler radar capabilities and other data sources. Coastal Doppler radars will provide greater capability to monitor and predict detailed local storm hazards as they move from land to sea and vice versa over the 100 nm seaward coverage area. In a few cases such as in New England and Alaska, the new seaward coastal forecast boundary varies due to geography and other considerations.

Beyond the Coastal Areas—Marine warnings and forecasts for the oceans beyond the approximate 100 nm coastal boundary will be provided by the Marine Prediction Center in Washington, D.C., the Tropical Prediction Center in Miami, Florida, and the NWS offices in Anchorage, Honolulu, and Guam. (The Marine and Tropical Prediction Centers are two of the seven new National Centers for Environmental Prediction.) These offices have the resources and staffing to deal with weather conditions over the large offshore and high seas areas beyond 100 nm. Thus, the field offices that were responsible for these large ocean areas can now concentrate on the localized weather hazards within the coastal areas monitored continuously by their Doppler radars.

Coastal & Offshore Reconfiguration

Figure 2 shows the current marine warning and forecast areas and the offices to which they are assigned. *When all the coastal Doppler radars are operational, the areas will be extended out to approximately 100 nm and realigned with the overwater Doppler radar coverage, as shown in **Figure 3**. This change is planned to occur in the Spring of 1997. These areas are assigned to the same offices as shown in **Figure 2**.* The other offices in **Figure 3** will issue only localized "short fuse" warnings for segments of the reconfigured forecast areas prior to becoming WFOs, as described in the previous section. In addition, each area will be subdivided into nearshore and offshore "zones" in order to describe warnings and forecasts in more detail to promote a higher level of safety. This is similar to the way the forecasts for the general public are structured over land to account for climatic and geopolitical differences.

After delivery and operation of the new AWIPS computer system to the

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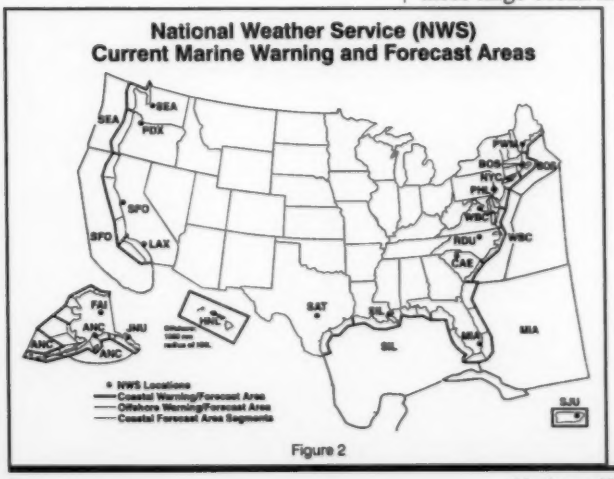

Figure 2

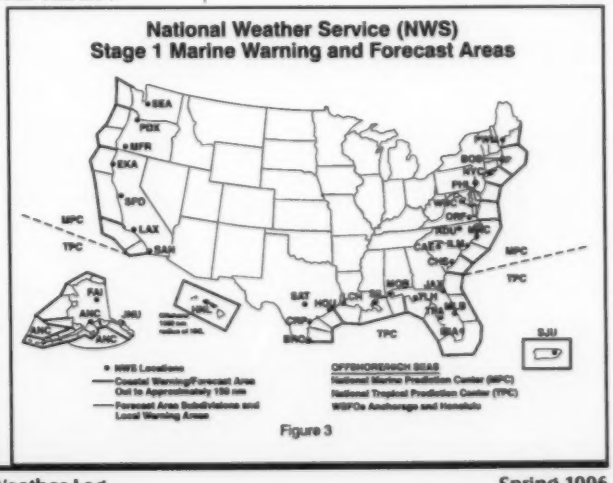

Figure 3

NWS Modernization

Continued from Page 5

field, the WFO office structure will begin to go into effect. At that time (early 1998) the new coastal marine forecast areas shown in **Figure 3** will start to be redistributed as coastal WFOs are commissioned, eventually looking like that shown in **Figure 4**.

Due to the extension of the coastal forecast boundary further out to sea, it will be impractical to describe the overwater area of the forecast by simply giving coastal landmarks and saying "out to 100 nm." A look at **Figure 4** shows why. In some parts of the country "out to 100 nm" could have different meanings in terms of the direction by which the seaward boundary is measured (is it 100 nm southeast from the coast, east from the coast, etc.?). Instead, *each forecast area assigned to a coastal NWS office, as shown in **Figures 3 and 4**, will be described by use of a well-known geographic descriptor, such as MARVA SHELF for the coastal marine area assigned to the Norfolk weather office, similar to the method of description used by Canadian and European weather services.* To ensure that the marine community understands and becomes accustomed to the descriptions, NWS will advertise the new areas through revised Marine Weather Service Charts, revised nautical charts, updated NWS brochures, U.S. Coast Guard and Defense Mapping Agency publications, articles such as this, and other outreach efforts. A dual description (geographic coordinates plus descriptor) also will be used for a period of time in the coastal forecast heading to help mariners become accustomed to the descriptors.

As indicated earlier, the present marine warning and forecast program includes services for Offshore and High Seas areas. **Figure 2** shows these areas and the NWS offices responsible for them. *In spring 1997, when all the coastal Doppler radars are operational and the coastal forecast areas are extended uniformly out to about 100 nm from new coastal landmarks (as described earlier and shown in **Figure 3**), the Offshore forecasts will no longer be issued by the field offices. Except for the NWS offices in Anchorage and Honolulu, all warnings and forecasts for the ocean beyond the coastal areas shown in **Figure 3** will be issued in conjunction with the High Seas program operated by the National Marine Prediction Center and the National Tropical Prediction Center.*

At this time, it is uncertain whether the Offshore forecasts shown in **Figure 2** will continue to be issued in their present form or as part of the High Seas forecast package. The NWS is examining several options to ensure that maritime interests operating beyond 100 nm from shore receive the weather information necessary to their safety and productivity.

Great Lakes

Marine Warnings and Forecasts for the Great Lakes consist of Open Lake and Nearshore services. They will remain basically unchanged in terms of areas of responsibility assigned to the local weather offices. This is because the Doppler radar will have extensive overlapping coverage of the entire U.S. portion of the Great Lakes, as shown in **Figure 1**. The only major changes will be:

- Realignment of some of the nearshore areas (0-5 nm out) in the upper lakes with different coastal landmarks as the individual Doppler radars become operational.

- Transfer of responsibility for Lake Superior warnings and forecasts from the Romeoville,

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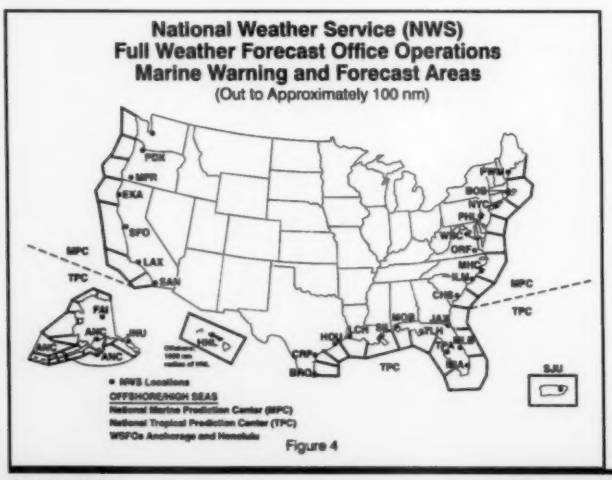

Figure 4

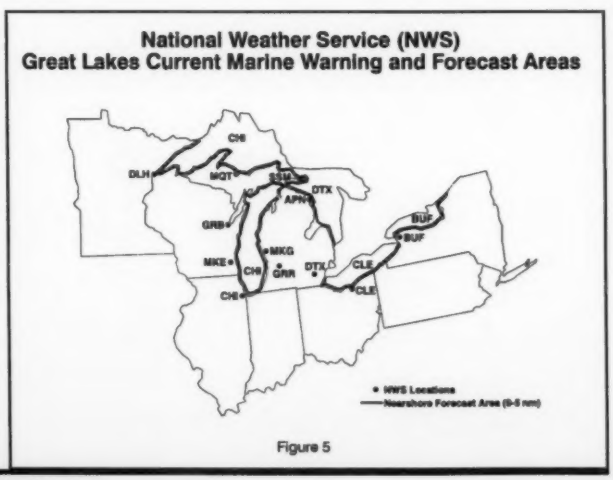
National Weather Service (NWS)
Great Lakes Current Marine Warning and Forecast Areas
• NWS Locations
Nearshore Forecast Area (0-5 nm)

Figure 5

NWS Modernization

Continued from Page 6

Illinois (Chicago) office to the future WFO in Marquette, Michigan, after the AWIPS computer system becomes operational.

Figure 5 shows the current responsibilities for the Great Lakes, and **Figure 6** shows the future office (WFO) assignments. To complement the individual nearshore and open lake forecasts, the NWS office in Cleveland will continue to issue certain forecast and warning products covering the entire Great Lakes region.

Cooperation with the Private Weather Information Sector

The NWS marine warnings and forecasts are general products designed to provide basic information on winds, waves, weather, ice, and visibility as they affect safety of life and property at sea. These marine products and services are developed and refined from a broad consensus of requirements put forth by all sectors of the maritime community.

Specialized marine weather analyses, forecasts, data sets, and packaged information to meet specific requirements of individual maritime users or segments of the community are the responsibility of the private weather information industry. For example, the NWS will not issue forecasts of wind or wave conditions for specific locations and times upon request of a marine user requiring such services. *It is the strict policy of the NWS to refer all such requests for specialized or tailored services to the private sector.*

To assist the private sector in providing specialized products and services and to promote the economic viability of the industry, the NWS provides subscriber access to the Family of Services computer system for receipt of a whole range of data and products. The NWS encourages users to take advantage of these specialized services offered by the private weather information industry in the hope that access to a combination of NWS and private sector weather products will provide the user with the most complete and comprehensive weather information to enhance maritime safety and productivity.

Summary

The Doppler radar and the other new observing technologies are proving to be valuable tools for predicting severe weather conditions that impact marine safety ranging from localized severe thunderstorms and squalls to major ocean storms. Installation of AWIPS systems is planned to begin in 1997 soon after completion of the coastal Doppler radar network. A more streamlined field office structure, staffed with highly trained meteorologists and supported by improved National Center guidance, will allow the NWS to derive maximum benefit from the technological advances. The growing partnership between the NWS and the private weather information industry will afford marine users an extra margin of safety and efficiency through a combination of basic warnings and forecasts and highly specialized weather information to meet unique operational requirements. The NWS is confident that by the end of the decade, people who live, work, and play along the nation's coastline and at sea will experience a substantially higher level of weather services for the protection of life and property and in support of their daily activities.⚓

National Weather Service (NWS)
Full Weather Forecast Office Operations
Great Lakes Marine Warning and Forecast Areas

Figure 6

Mesoscale Buoy Network

Continued from Page 1

Each platform reports 8-min averages of wind speed (including peak 5-s wind), peak 5-s wind, wind direction, water temperature, air temperature, current directions and speeds sampled at 1 Hz, and significant wave height and dominant wave period for 9 minutes at 1 Hz sampling. The 9-min sample of wave data is different from the standard 20-min NDBC averaging period; however, this will not degrade the wave data for operational use. Table 1 lists reporting information, sampling characteristics, and accuracies for the measurements.

Raw measurements are processed onboard the buoy and transmitted to the NWS forecasters via two independent telemetry links (Figure 3). The standard means are via a National Oceanographic and Atmospheric Administration (NOAA) Geostationary Operational Environmental Satellite (GOES), operated by the National Environmental Satellite, Data, and Information Service (NESDIS). The messages are transmitted once every hour and undergo automatic quality checks at the NWS Telecommunications Gateway (NWSTG) in Silver Spring, Maryland, before real-time dissemination in FM13 SHIP code format over the NWS's Automation of Field Operations and Services (AFOS) and the Global Telecommunications Service (GTS). Subsequently, these data also are reviewed daily by experienced NDBC data analysts who are able to correct or block the release of any suspect data measurements until appropriate corrections can be made.

However, the NWS's team of marine forecasters at the Olympics required more frequent observations to adequately support the Games. As a result, NDBC modified its system to provide more frequent reports via a line-of-sight link and developed the user-friendly Olympic Buoy Display System (OBDS). For this project, the buoys were reprogrammed to collect new data every 10 minutes. The more frequent data are sent by line of sight to shore and are entered into an NWS network on scene in FM13 SHIP code. The OBDS provides the same data, but updated measurements are made available six times each hour by automatically polling each buoy every 10 minutes. The polling triggers transmission of the most recent 10-min updated data frame from the respective buoy. Data from each of the three buoys are automatically updated, displayed, and stored in the OBDS. Besides more frequent reports, the OBDS will make the standard hourly measurements available on the local network 15 to 20 minutes earlier than via the GOES link.

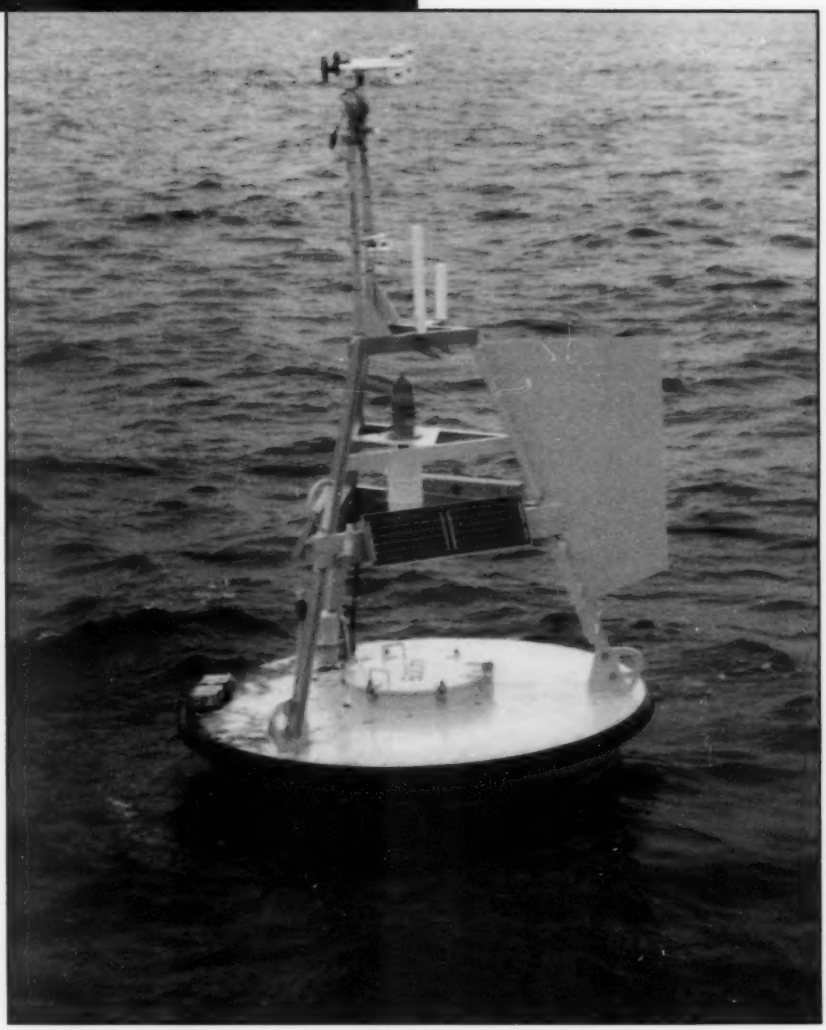

Figure 2. 3-m Moored Buoy

The OBDS provides several display options of a specified meteorological or oceanographic observation from all three buoys, or up to three different measurements from one of the buoys.

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Mesoscale Buoy Network

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For example, one display posts all latest observations; another provides plots of specified data versus time to help forecasters visualize trends. All collected data are stored in files that can be copied or viewed using Windows applications. The forecasters are given several control options to limit any unrepresentative or degraded data appearing in the FM13 SHIP messages.

These special buoys will be operating through August 1996. Used with data from existing stations in the general area, such as in NDBC's Coastal-Marine Automated Network (C-MAN) station at Savannah Light, Georgia, that has the station identifier SVLS1, there will be unusually good availability of marine observations in the area during most of this summer.⚓

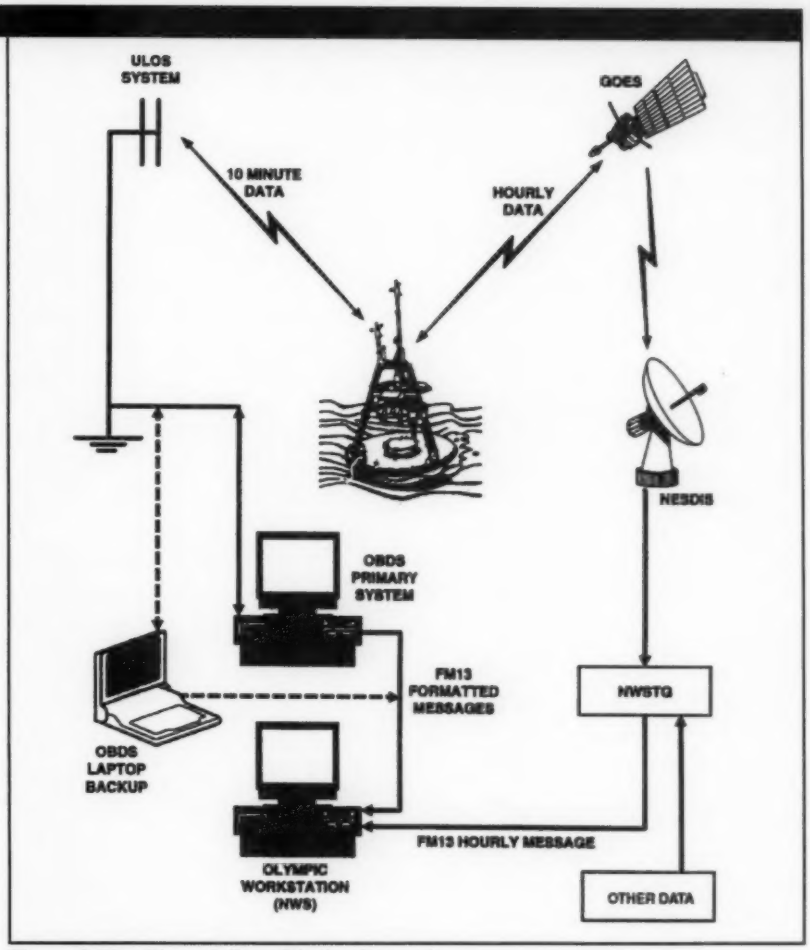

Figure 3. The Olympic Data Display Network

PARAMETER	REPORTING RANGE	REPORTING RESOLUTION	SAMPLE INTERVAL	SAMPLE PERIOD	TOTAL SYSTEM ACCURACY
WIND SPEED	0 TO 62 m/s	0.1 m/s	1 s	8 min	±1 m/s or 10%
WIND DIRECTION	0 TO 360E	1E	1 s	8 min	±10E
PEAK WIND	0 TO 82 m/s	1 m/s	1 s	8 min	±1 m/s or 10%
AIR TEMPERATURE	-40 TO 50 EC	0.1 EC	90 s	8 min	±1 EC
BAROMETRIC PRESSURE	800 TO 1100 hPa	0.1 hPa	4 s	8 min	±1 hPa
SURFACE WATER TEMPERATURE	-7 TO 41 EC	0.1 EC	1 s	8 min	±1 EC
SIGNIFICANT WAVE HEIGHT	0 TO 35 m	0.1 m	0.39 s	9 min	±0.2 m or 5%
WAVE PERIOD	3 TO 30 s	0.1 s	0.39 s	9 min	±1 s
SURFACE OCEAN CURRENT SPEED*	0 TO 110 cm/s	1 cm/s	1 s	8 min	±5 cm/s*
SURFACE OCEAN CURRENT DIRECTION*	0 TO 360E	1E	1 s	8 min	±10E*

* SYSTEM ACCURACIES BASED ON LIMITED FIELD EVALUATIONS

Table 1. Reporting and sampling characteristics for measurements taken by NDBC buoys during the 1996 Olympics.

National Prediction Center Reports

Marine Prediction Center

Dear Mariner,

It is my pleasure to inaugurate a regular series of Marine Prediction Center (MPC) columns in the Mariners Weather Log. While in future articles you will be hearing from operational marine forecasters about technical items of interest to mariners, I would like to take the opportunity to familiarize you with the structure of MPC and some of the progress we have made in bringing warning and safety information to marine users. I will also bring you up to date on our plans to improve operations further.

The MPC is one of nine centers of the National Centers for Environmental Prediction (NCEP)—formerly the National Meteorological Center (NMC)—which is a major component of the National Weather Service (NWS). The MPC mission is to prepare and issue warnings and forecasts of marine atmospheric variables for the purposes of protecting life and property and ensuring safety at sea. These weather products support marine navigation, fisheries, coastal communities, and other marine interests.

The MPC is composed of two major sections, the Marine Forecast Branch (MFB) and the Marine Applications Branch. The latter is concerned with developing new techniques that can be used by operational forecasters in the MFB to provide the best possible marine forecasts. Many of you are already familiar with the MFB, which operates 24 hours per day and provides the radiofacsimile charts and forecast bulletins you have become accustomed to receiving at sea. In addition to providing safety information to mariners on the high seas of the north Pacific and north Atlantic oceans, the MFB also interacts closely and frequently with other NWS offices that issue near-shore warnings and forecasts. In this role it furnishes advice and guidance to ensure accurate and consistent warning and forecast information is provided to marine interests in waters along the U.S. east and west coasts. It also routinely coordinates its activities with the Tropical Prediction Center.

Over the past several years the NWS has worked hard to expand and improve its services to the marine user. Back in June 1989 the first step toward consolidating NWS marine services and forming the MPC was taken. At that time the Atlantic high seas forecast bulletin function was transferred to NCEP's forbearer, the NMC. In March 1991 both the Pacific high seas marine forecast bulletins and the USCG Point Reyes Pacific radiofacsimile broadcasts began production at NMC. In March 1993 the MFB was formed and the radiofacsimile broadcasts were expanded to include the Atlantic broadcast from the USCG communication facility in Marshfield, Massachusetts. A regional marine forecast desk was instituted in January 1994 to provide advice and guidance to NWS coastal offices. At the same time the quality control of marine observations — those invaluable observations you provide — was undertaken by the MFB. A month later the radiofacsimile broadcasts to both oceans were significantly expanded. In October 1995 the MPC was formed as part of the reorganization of NMC into NCEP and shortly thereafter we inaugurated a new and improved means of distributing our radiofacsimile products. Our most recent improvement in distributing our products was making them available on the Internet. They can be found on the world wide web at URL: http://www.nws.noaa.gov/marine.htm

The MPC will continue to evolve as we look forward to bringing improved products and services to the marine user in the coming years. Plans include expanding our radiofacsimile program by providing longer-range surface and upper-air charts as well as 6- to 10-day storm track charts for both oceans. In addition, as part of the larger NWS modernization effort, we expect to be taking over forecast responsibilities in the near-shore areas of the east and west coasts. And we are looking closely at the possibility of adding forecasts of ocean currents on our broadcast charts including forecasts of the Gulf Stream position. Our computer support staff is in the process of developing new computer software for preparing radiofacsimile charts. This will eventually eliminate hand drawing and will result in more consistent, uniform, and easy-to-read graphical products.

As you may be aware, over the past year or so there was serious talk of discontinuing the U.S. radiofacsimile program due to budgetary constraints. We are optimistic that a solution to this problem has been found and we expect to be on the air for the foreseeable future. This is due, in no small measure, to the vocal support many of you have shown for our program.

We pride ourselves on focussing our efforts on the needs of the mariner. The improvements made in our program thus far have been a consequence of input in the form of suggestions and comments from many of you. We encourage your continued input to help us develop our plans for

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Mean Circulation Highlights and Climate Anomalies

First Quarter 1996

A. James Wagner

The maps (on Page 12) of average 500-mb height and height anomalies (left) and average sea level pressure (SLP) and anomalies (right) readily show the principal long-lasting circulation features and their anomalies that affected the climate over the Northern Hemisphere during the first three months (Jan-Feb-Mar) of 1996. The most prominent feature is the large area of blocking (above normal middle-tropospheric heights and accompanying SLP anomalies) situated over high latitudes of the Atlantic and Eurasian sectors, with pronounced negative anomalies in both fields to the south, especially from the eastern Atlantic west of the Iberian Peninsula across the Mediterranean Basin and the bordering land masses of southern Europe and North Africa. An area of positive middle-tropospheric height anomalies at high latitudes is usually referred to as blocking if it is strong enough to disrupt, or block, the normal west-to-east progression of weather systems at middle and high latitudes. The jet stream, which acts as a steering current for the mobile cyclones and anticyclones that produce the day-by-day weather, is often split into two branches, with one branch deflected northward west of the area of blocking, and the other branch cutting eastward to the south of the block.

During the first three months of 1996, storms in the Atlantic sector of the Northern Hemisphere have tended to either move sharply north-northeastward towards the Davis Strait or head eastward at lower latitudes than usual with a tendency for reintensification as they approached southwestern Europe or northwestern Africa. The result was an unusually cold and dry period over northern Europe and rather wet conditions over southern Europe and North Africa.

Blocking was also evident over the Pacific sector, although it was not as strong as over the Atlantic. The somewhat enhanced jet stream over the western Pacific with a tendency for split flow over the eastern Pacific is often a typical circulation pattern during the cold seasons of years in which the El Niño/Southern Oscillation (ENSO) phenomenon is in the cold phase, i.e., below normal sea surface temperatures over the eastern and central equatorial Pacific. Such has been the case since the summer of 1995.

Teleconnection studies have shown that the large-scale patterns over the two oceans are often independent of each other, although each has a preferred response over the North American sector. The circulation over North America was characterized by many vigorous storm systems and much variability from week to week, so seasonal extremes of temperature were not so pronounced there, even though numerous records were established for daily cold, and in some cases, warmth. The prevailing pattern of anticyclonic westerly flow over the southwest and southern half of the Great Plains tended to suppress the precipitation-producing mechanisms in those areas and led to pronounced dryness, while the somewhat amplified mean trough in the 500-mb flow over the midwestern and northeastern parts of the U.S. was related to the above normal incidence of cold and precipitation in those areas. Several cities in the northeastern megapolis corridor reported record seasonal snowfall totals that caused frequent severe disruptions to normal commerce and travel.

The author is the Senior Forecaster in the Prediction Branch of the Climate Prediction Center/NCEP/NWS/NOAA. He participates in the preparation of all the types of forecasts done in the Branch: 6-10 Day Extended Outlooks, ½-month lead Monthly Outlooks, and the series of long-lead Seasonal Outlooks going out to a year ahead. Other duties of Mr. Wagner include applied research in developing tools for the various types of forecasts and giving special briefings on the forecasts and their methodology to the media and visiting scientists.⚓

Marine Prediction Center

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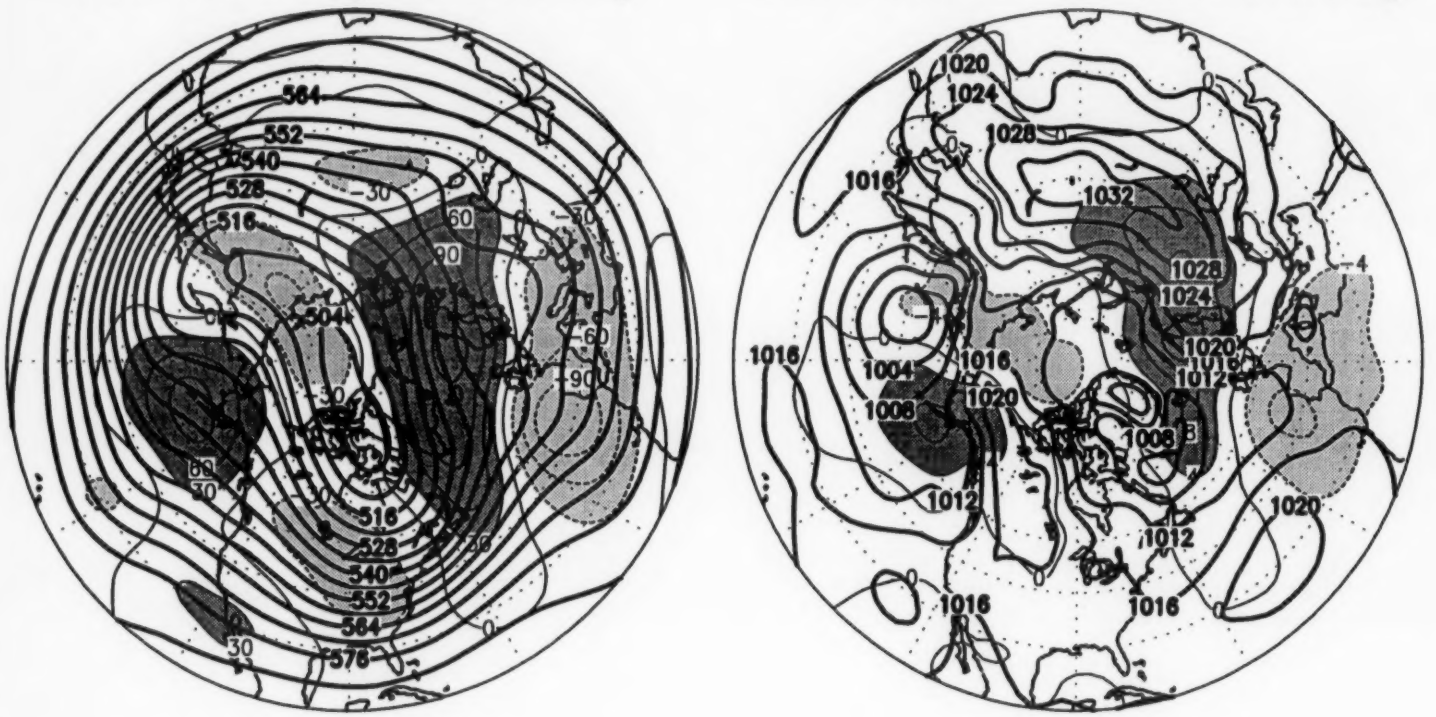
further improvements. We would also appreciate your suggestions for future MPC columns. Please feel free to contact us at: National Weather Service, National Centers for Environmental Prediction, Marine Prediction Center, W/NP4, Room 410, Washington, DC 20233. Our fax number is (301) 763-8085 and our voice number is (301) 763-8441. Email: feit@smtpgate.ssmc.noaa.gov

Thank you for your support and we hope you will find the information we provide in this column beneficial to your activities.

Sincerely,
Dr. Jim Hoke
Director, Marine Prediction Center⚓

January–March 1996



The chart on the left shows the seasonal mean 500-mb height contours at 60 m intervals in solid lines, with alternate contours labeled in decameters (dm). Height anomalies are contoured in dashed lines at 30 m intervals. Areas where the mean height anomaly was greater than 30 m above normal have heavy shading, and areas where the mean height anomaly was more than 30 m below normal have light shading.

The chart on the right shows the seasonal mean sea level pressure at 4 mb intervals in solid lines, labeled in mb. Anomalies of SLP are contoured in dashed lines and labeled at 4 mb intervals, with heavy shading in areas greater than 4 mb above normal, and light shading in areas more than 4 mb below normal.

Tropical Prediction Center

January– March 1996

Dr. Jack Beven
Andrew Shashy
Tropical Prediction Center
Tropical Analysis and Forecast Branch

I. Introduction

Welcome back to the Mariners Weather Log! This column will highlight the analysis and forecast activities of the Tropical Prediction Center (TPC) and summarize the significant quarterly weather in our area of responsibility.

The TPC is part of the National Centers for Environmental Prediction (NCEP) and is composed of three main units. The best known is the National Hurricane Center (NHC). NHC is responsible for advisories and warnings on all tropical cyclones in the Atlantic Ocean, as well as those in the northeast Pacific Ocean east of 140W. (The name NHC formerly applied to the entire center. It is now the title for the Hurricane Specialists and associated personnel.) NHC meteorologists are busy year-round. The hurricane season runs from June 1 through November 30 in the Atlantic and May 15 through November 30 in the northeastern Pacific. In the off-season, NHC meteorologists are involved in teaching, training, and coordination programs with meteorologists and emergency managers from around the world.

The second unit is the Tropical Analysis and Forecast Branch (TAFB). This unit produces high seas forecasts, aviation forecasts and warnings (SIGMETs), as well as many surface analyses. The unit also produces satellite interpretation messages, satellite rainfall estimates, and satellite intensity estimates of tropical cyclones. There is no off-season in TAFB as the unit is open 24 hours a day, every day of the year.

The third unit is the Technical Support Branch (TSB). This unit is responsible for software and hardware development and maintenance on all TPC computer systems. These include the Man Computer Interactive Data Access System (McIDAS) and the National Advanced Weather Information Processing System (N-AWIPS). The unit also does applied research on tracking and forecasting tropical cyclones.

More information on TPC is found on our Wide World Web page at URL http://www.nhc.noaa.gov/

II. TAFB Marine Forecasts

January through March is a time for winter storms even in our forecast area. Thus, it is a good time to look at TAFB's marine forecasts. TAFB has high seas forecasting responsibility in three areas:

1. The Atlantic Ocean from 3N to 32N west of 35W, including the Caribbean Sea and the Gulf of Mexico.

2. The northeastern Pacific Ocean from the Equator to 30N east of 140W.

3. The southeastern Pacific Ocean from the Equator to 18.5S east of 120W.

TAFB issues high seas forecasts every six hours for periods of up to 36 hours. They include warnings for gale, storm, and tropical cyclone conditions. They also include a synopsis and forecast of significant weather features (such as tropical cyclones, frontal systems, and wind-producing ridges) and forecasts of significant wind and wave conditions. In the Atlantic, the significant wind and wave criteria are 20 knots and 8 feet. In the Pacific, they are 25 knots and 8 feet.

How does TAFB make a high seas forecast, and what goes into it? Here's how the process works:

1. Data

The first step in a marine forecast is to examine the data to determine the initial conditions. Data sources include:

a. Ship observations—get those into us, mariners! They're very important, especially near tropical cyclones and other strong storm systems.

b. Automated observations from buoys and Coastal Marine Automated Network (C-MAN) stations. These are very useful in the Gulf of Mexico and near the Atlantic coast, but they are rare on the high seas.

c. Land station observations. These are examined where useful.

d. Satellite observations. These include three data types. First, satellite cloud drift winds from geostationary satellites provide information on low level (but not necessarily surface) winds. Second, microwave imager data from the Department of Defense polar orbiting satellites provides wind speed information. Third, the European ERS-1 and ERS-2 polar orbiting satellites provide microwave wind speed and direction data on an experimental basis. One useful practice is to overlay available surface data on satellite imagery. This allows for easier identification of significant

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Tropical Prediction Center

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weather features and areas of significant winds and waves. The overlays are currently done on the McIDAS system, and this capability will eventually be built into the N-AWIPS system.

2. Compare Data and Analyses to Models

TAFB produces a surface analysis of the high seas regions every six hours employing all available surface data and interpreted satellite imagery. This helps the forecaster track significant features.

TPC receives gridded model data from NCEP through the N-AWIPS systems. A variety of models are available, with the Aviation (AVN), η, and Nested Grid Model (NGM) most frequently used in high seas forecasts. The high seas forecaster will typically use gridded boundary layer winds at six hour intervals when making the forecast. The model data show what will happen to areas of significant winds and waves that are initially present, and what new areas may develop during the forecast period.

Another model employed by TAFB is the WAM model. This provides a wave and swell forecast based on AVN model winds and a coupled ocean model. This provides information on how wave conditions will develop during the forecast, particularly for swells propagating into the forecast area from far away.

An important step is checking model information against data and surface analyses. The analysis systems used as model input do not always properly analyze the wind fields and significant weather systems. Such errors may propagate through the model forecasts. For example, an oceanic region where the model analyzed winds are too low could stay too low through the forecast. Checking the models against the data reveals such problems and allows the forecaster to correct potential model problems.

3. Coordination

Coordination is an essential part of a TAFB high seas forecast. Items requiring coordination include:

a. Tropical cyclone information—current and forecast tropical cyclone positions, intensities, and wind radii are taken directly from NHC advisories.

b. Gale and storm warnings—gale and storm warnings overlapping with other areas of responsibility are coordinated with the appropriate office. Offices that TAFB coordinates with include the Marine Prediction Center (MPC), and the forecast offices in Honolulu, Miami, and New Orleans. This allows the forecaster to get other opinions on the weather situation and to reach a consensus on the forecast.

c. Offshore forecasts—the Atlantic high seas forecast area overlaps with the offshore waters forecast areas of Miami (for the Atlantic south of 32N west of 65W) and New Orleans (Gulf of Mexico). Generally, the high seas forecaster will follow the lead of the local offices in these areas. However, any disagreements on current or forecast conditions are resolved through coordination calls.

4. Forecast Assembly

The final forecasting step is to put all available information together. The forecaster combines the current data, model forecasts, coordination information and his meteorological knowledge and judgement to produce the final product.

5. Dissemination

TAFB transmits its forecast to MPC and to the National Weather Service's communications gateway. It is then distributed by several methods, including:

1. Transmission through the Family of Services to all sites that receive that data.

2. Direct satellite transmission. (For the southeast Pacific forecast.)

3. Appending to the MPC forecast, then satellite transmission. (For the northeast Pacific and Atlantic forecasts.)

4. Radiofax transmission from the U.S. Navy in Norfolk, Virginia and U.S. Coast Guard in Belle Chase, Louisiana.

TAFB also produces a 18- and 36-hour graphical marine forecast for the Gulf of Mexico. This is produced twice a day at the 0600 and 1800 UTC synoptic times, and it includes wind and wave forecasts for selected points. It also includes depictions of warning areas and significant weather features. This product is disseminated through radiofax.

III. Significant Weather of the Quarter

No tropical cyclones occurred in NHC's area of responsibility during January—March 1996. Atlantic tropical and subtropical cyclones are very rare during this period. The only known occurrences took place in March 1908, February 1952, January 1955, and January 1978. There is no

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record of any northeastern Pacific tropical cyclone during this quarter.

a. Atlantic

The outstanding storm of the quarter was the southeastern U.S. coastal storm of 10–12 March. The precursor of the system was a strong cold front that moved across Florida into the Bahama Islands on March 8. Strong high pressure built in behind the front, creating strong east to northeast flow. A frontal wave formed near 21N 74W at 0000 UTC March 10 in response to an upper level low moving into the eastern Gulf of Mexico. The wave drifted north and strengthened to a 1012 mb low by 0000 UTC March 11. The original center moved across Grand Bahama Island (Figure 1) to near 27N 78W by 0000 UTC 12 March as the central pressure dropped to 1000 mb. Then, a second 1004 mb center developed near 32N 70W (Figure 2). The combination of the double-barreled low and the strong high to the north produced gale- to storm-force winds over the northeast Florida coast and the adjacent waters. By 0000 UTC 13 March, the northeastern center had moved north of TPC's area of responsibility and become the predominant center. This caused the original center to weaken and move east, which ended the worst conditions in the southeastern U.S.

There are many ship reports of gale- to storm-force winds. Ship FLIG4 reporting 50 knot winds with 25 foot (7.5 m) seas and 30 foot (9 m) swells at 1800 UTC 12 March. Moored buoys off the northeast Florida coast reported seas up to 29 feet (8.8 m). Maximum buoy winds were 39 knots with gusts to 49 knots at buoy 41010 around 2300 UTC 11 March. A pier near Daytona Beach reported an unofficial 52 knot gust.

Heavy rains accompanied the storm over Florida, with some locations in east central Florida reporting 6–7 inches. Some snow and sleet occurred over northern Florida and southern Georgia during the storm's initial development with no accumulation reported.

Table 1 summarizes peak wind gusts and storm total rainfalls for southeast and east central Florida. The storm caused significant beach erosion along the northeast Florida and Georgia coasts due to high tides and surf. Part of a fishing pier collapsed at Flagler Beach, Florida. Some minor structural damage was reported due to tidal or rainwater flooding. Some minor wind damage was reported, primarily to signs. No monetary damage figures are available as this goes to press.

No other significant storms occurred in the TPC's forecast area. However, many gale episodes occurred over the area. A large storm centered north of the area caused gales over the northeast part of the forecast area on 1–3 January. A similar episode occurred on 17–19 February. Several passing cold fronts produced gales over the Gulf of Mexico, with the most notable examples on 2–3 January and 7–8 March.

b. Pacific

No significant storms occurred in TPC's forecast area. However, several systems located northwest of the area produced gale and near gale winds in the forecast area, with the most notable examples on 29 February and 8 March. Several episodes of gale- and storm-force winds occurred in the Gulf of Tehuantepec and adjacent waters. These were due to cold air surges moving through the Gulf of Mexico and across the Isthmus of Tehuantepec. The most prominent examples occurred on 7–9 January and 8–12 March.

The 8–12 March episode (Figure 3) was associated with a major surge across much of Mexico and Central America. It was unusually widespread, severe, and prolonged. Gale- and storm-force winds occurred across much of the Pacific north of 10N and east of 105W.

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Station	Pk Gust (kt)	Rainfall (in)
Coral Springs	N/A	4.30
Daytona Beach	40	5.37
Fort Lauderdale	N/A	.85
Fort Pierce	30	N/A
Homestead	N/A	0.81
Melbourne Beach DARDC	43	N/A
Melbourne NWS	30	6.77
Miami	N/A	0.91
Miami Beach	N/A	0.71
Nasa Shuttle Facility	44	5.20
North Dade county	N/A	0.81
Orlando (McCoy)	36	2.60
Patrick AFB	51	3.93
Tamiami Airport	N/A	0.84
Titusville	38	N/A
Vero Beach	43	5.24
West Palm Beach	N/A	2.99

Table 1. Peak wind gusts and storm-total rainfalls for the March 10-12 coastal storm.

Tropical Prediction Center

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IV. Start of the 1996 Hurricane Season

The northeastern Pacific hurricane season starts on 15 May, while the Atlantic season starts on 1 June. Here are the name lists TPC will use for these basins for 1996:

Atlantic	Northeastern Pacific
Arthur	Alma
Bertha	Boris
Cesar	Cristina
Dolly	Douglas
Edouard	Elida
Fran	Fausto
Gustav	Genevieve
Hortense	Hernan
Isidore	Iselle
Josephine	Julio
Kyle	Kenna
Lili	Lowell
Marco	Marie
Nana	Norbert
Omar	Odile
Paloma	Polo
Rene	Rachel
Sally	Simon
Teddy	Trudy
Vicky	Vance
Wilfred	Winnie
	Xavier
	Yolanda
	Zeke

These lists are the same as those used in 1990, except that Dolly has replaced Diana and Kyle has replaced Klaus on the Atlantic list.

Dr. Jack Beven and Andrew Shashy are marine and aviation forecasters in the Tropical Analysis and Forecast Branch of the Tropical Prediction Center. Dennis Decker (Warning Coordination Meteorologist, NWS Melbourne, Florida), James Lushine (Warning Coordination Meteorologist, NWS Miami, Florida), and Scott Spratt (Forecaster, NWS Melbourne, Florida) contributed information on the coastal storm.⚓

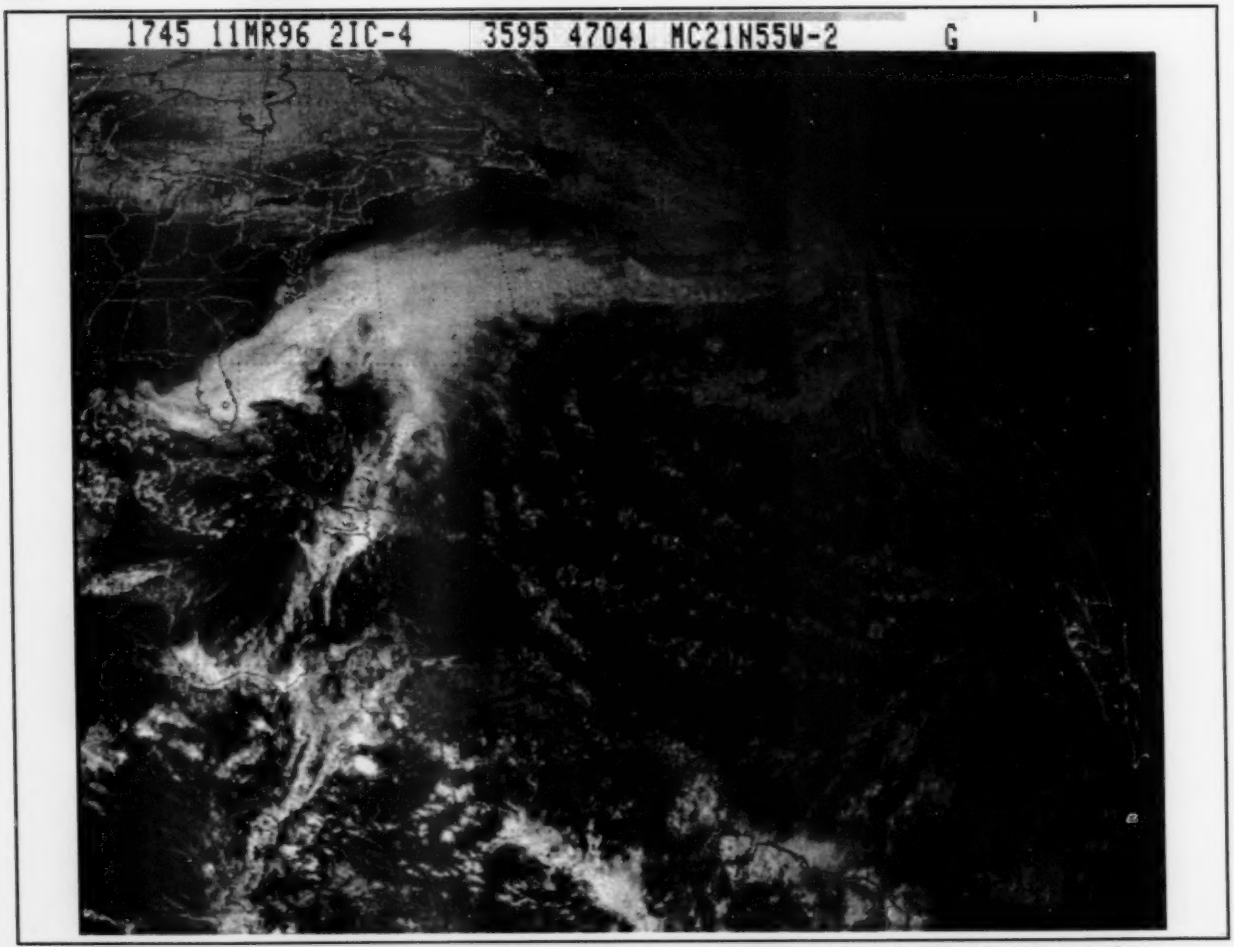

Figure 1. GOES-8 visible satellite imagerly of the coastal storm at 1745 UTC 11 March. The primary center is near Grand Bahama Island, with a secondary center forming near 31N 70W.

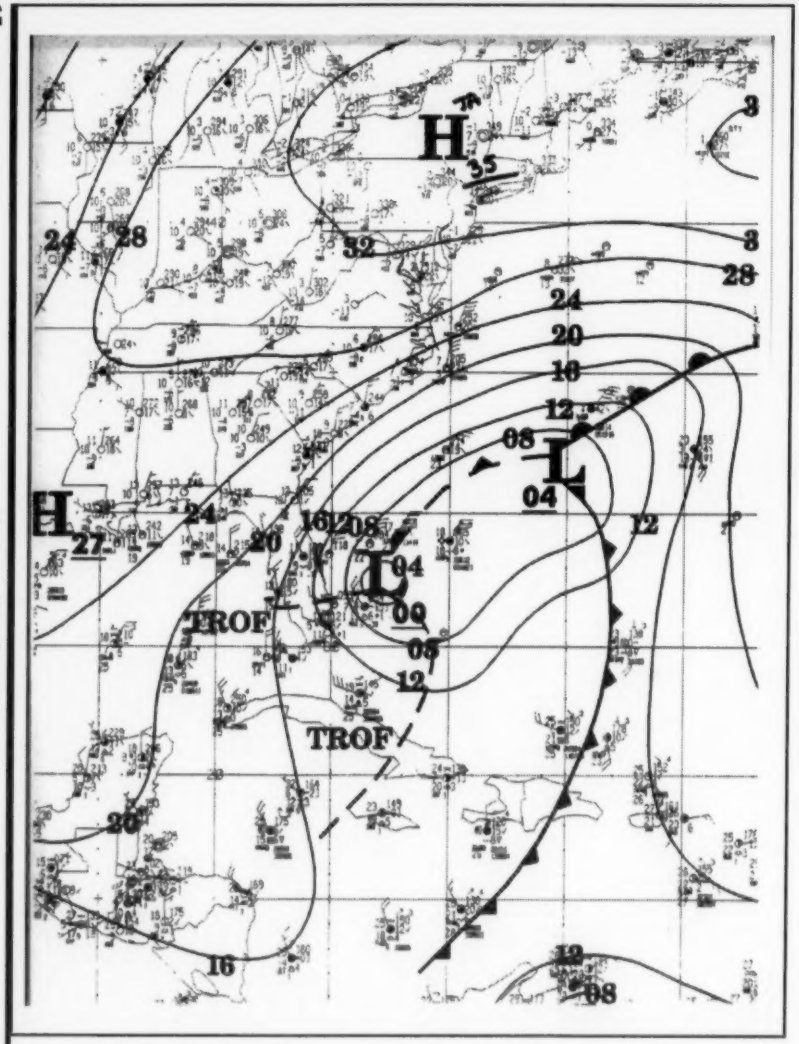

Figure 2. TAFB surface analysis at 0000 UTC 12 March showing the coastal storm. Note the strong pressure gradient between the complex low center and the strong high pressure system over New England.

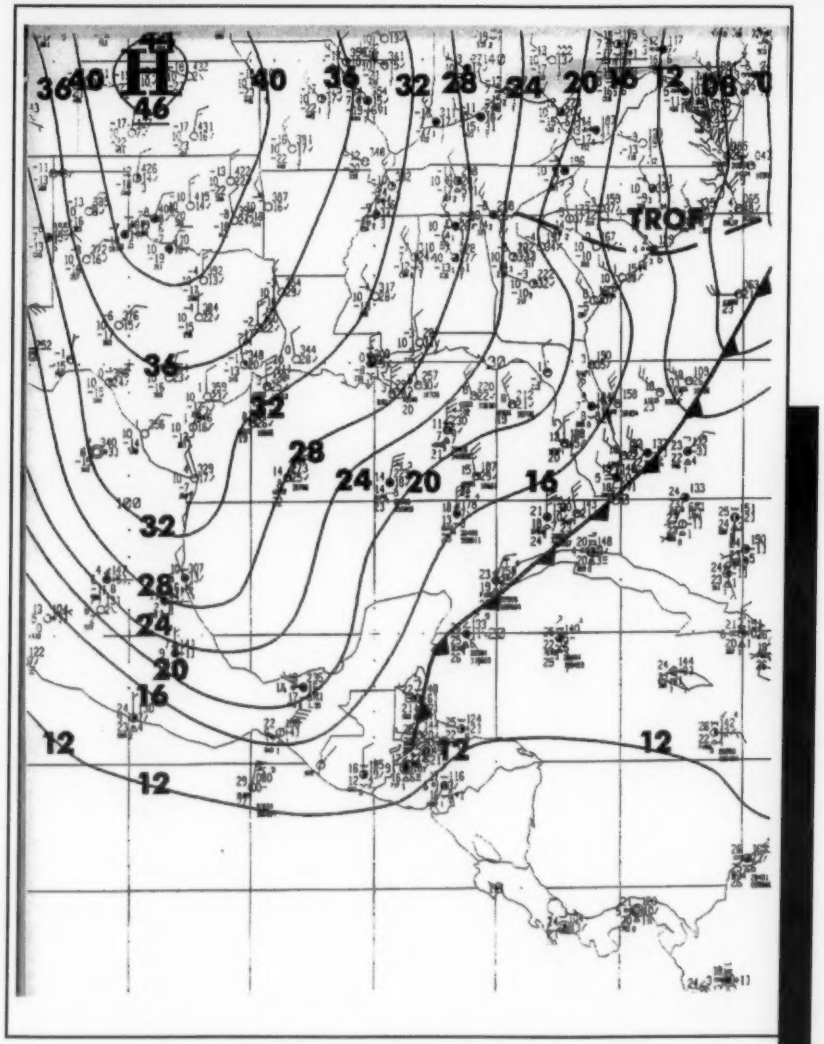

Figure 3. TAFB surface analysis at 1200 UTC 8 March showing the Gulf of Mexico and the Gulf of Tehuantepec. Notice the 60 kt ship report with 39 ft (12 m) seas near 14N 95W and the 40 kt wind at Arriaga, Mexico (WMO 76840).

Early April Atlantic Basin Seasonal Hurricane Prediction For 1996

(A year of expected somewhat-above-average hurricane activity.)

(Prepared for issue at the 18th Annual National Hurricane Conference, Orlando, Florida, April 5, 1996)

William M. Gray (Professor of Atmospheric Science), Christopher W. Landsea (Post-doctoral fellow at NOAA/HRD Lab., Miami, Florida), Paul W. Mielke, Jr., and Kenneth J. Berry (Professors of Statistics), and John A. Knaff (Advanced Ph.D. Student)

(This forecast is based on ongoing research by the authors, together with meteorological information through March 1996)

Abstract

This paper presents the authors' forecast of Atlantic tropical cyclone activity expected to occur during 1996. This forecast is based on a couple of new forecast schemes recently developed by the authors. One scheme is based on meteorological information through November 1995, and the other, a newer scheme, is based on somewhat different meteorological data through March 1996. Both forecast schemes predict nine individual seasonal tropical cyclone parameters. Each scheme chooses the best of five to seven (those resulting in the most skillful prediction) of ten forecast parameters as predictors. These ever-evolving forecast schemes use the following as possible predictors: forward extrapolations of the stratospheric Quasi-Biennial Oscillation (QBO) of equatorial zonal winds, two measures of West African rainfall, an extended range forecast of summertime El Niño conditions, an extended range forecast of Western Sahel monsoonal rainfall, and the October through November and March Atlantic subtropical ridge strength. In addition, other forecast parameters from the North Atlantic, the Pacific Ocean, and the Asia-Australia regions add additional qualitative assessments. We combine the results of both of these forecasts along with qualitative information not explicitly contained in either scheme to produce the final forecast values.

Information obtained through March 1996 indicates that 1996 Atlantic hurricane activity is likely to be somewhat greater than the average season with 7 hurricanes (average 5.7), 11 named storms (average 9.3), 55 named storm days (average 46), 25 hurricane days (average 23), 2 intense (category 3-4-5) hurricanes (average 2.1), 5 intense hurricane days (average is 4.5) and a hurricane destruction potential (HDP) of 75 (average 71). Collectively, net tropical cyclone activity is expected to be 105 percent of the long term average. The 1996 season should be much less active than the 1995 season, but more active than the average season of the last 25 years. This early April forecast anticipates a greater amount of 1996 hurricane activity than indicated by our late November forecast.

Background

A 10-page paper titled "Discussion of Atlantic Basin Seasonal Hurricane Activity in 1995 and Prospects for 1996" was written on 15 March 1996 for inclusion in the Annual National Hurricane Conference, Orlando, Florida, pre-conference material. This paper gives you background information for our new updated 5 April 1996 seasonal forecast. This report gives the final number of our early April forecast. A more complete explanation of this forecast with figures and tables is available on the World Wide Web. See the end of this article for access information. Thomas Milligan, Colorado State University, Media Representative (970-491-6432) is usually available to answer various questions about this forecast.

Early April Atlantic Basin Hurricane Forecast for 1996

We have recently developed a new Atlantic Basin seasonal hurricane forecast for issuance in early April. This early April forecast includes meteorological data through March. This gives four more months of information than is included in our 30 November 1995 forecast. About half of the predictors contained in our early April forecast are similar to the forecast parameters of our early December forecast and about half are different. Both schemes are based on 46 years of hindcast information (1950-1995). The skills of the two schemes are comparable, and we expect to obtain the best prediction by making a qualitative assessment using both of these forecasts. This early April assessment thus makes use of both our 30 November 1995 forecast and our recently developed early April forecast.

Table 1 shows our various 1996 hurricane season forecasts. The second column gives our corrected 30 November 1995 forecast. More recent and improved analysis of global conditions through November 1995 along with global circulation feature changes since November indicate that our 30 November 1995 forecast of storm activity for 1996 was too low. We found an error in one of the input parameters to our 30 November 1995

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Hurricane Prediction

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forecast. We have also been able to update some of the other information used in this forecast.

Our 5 April 1996 statistical prediction is given in the third column. This early April forecast also indicates a greater amount of hurricane activity than was originally anticipated. Our final qualitative adjusted forecast is shown in the right column of Table 1.

We now expect a somewhat above normal hurricane season for 1996. This is noteworthy considering that 1995 was one of the most active hurricane seasons on record. Usually there is reduced hurricane activity following very active seasons. Our update is based on more recent data and the projections of our newly developed early April forecast scheme.

Table 2 lists results of our corrected 30 November 1996 forecast and our newly developed early April forecast. The last column on the right gives our adjusted 5 April 1996 hurricane forecast which is a compromise between our corrected 30 November 1995 forecast, our early April statistical forecast and from other qualitative information relating to global circulation statistics which are not explicitly addressed in either scheme. This information includes Atlantic Ocean surface pressure and sea surface temperature anomalies, Pacific and Asian regional meteorological data such as the current state of the El Niño, Singapore 100 mb temperature anomalies, and other relevant information.

Thus, from the data analyzed through the end of March, we anticipate that 1996 will experience somewhat above

Forecast Parameter	30 Nov 95 1950-90 Average	Corrected April Statistical Forecast	Early Adjusted Statistical Forecast	5 April Forecast
Named Storms (NS)	9.3	10.1	12.8	11.0
Named Storm Days (NSD)	46.6	52.5	62.7	55.0
Hurricanes (H)	5.8	6.7	9.2	7.0
Hurricane Days (HD)	23.9	29.0	19.7	25.0
Intense Hurricanes (IH)	2.3	2.7	2.4	2.0
Intense Hurricane Days (IHD)	4.7	7.7	4.6	5.0
Hurricane Destruction Potential (HDP)	71.2	58.9	95.6	75.0
Net Tropical Cyclone Activity (NTC)	100.0	100.8	118.2	105.0
Maximum Potential Destruction (MPD)	66.0	73.2	77.7	75.0

Table 1: Updated statistical and adjusted Atlantic basin hurricane forecasts for 1996.

Forecast	30 Nov. 95 Parameter	5 April 96 Forecast	Increase Forecast
Named Storms (NS)	8	11	3
Named Storm Days (NSD)	40	55	15
Hurricanes (H)	5	7	2
Hurricane Days (HD)	20	25	5
Intense Hurricanes (IH)	2	2	0
Intense Hurricane Days (IHD)	5	5	0
Hurricane Destruction Potential (HDP)	50	75	25
Net Tropical Cyclone Activity (NTC)	85	105	20
Maximum Potential Destruction (MPD)	55	75	20

Table 2: 1996 Atlantic basin hurricane statistical and average forecast made on 30 November 1995 and revised early April forecast and the differences between the two.

average hurricane activity in comparison with the activity over the last 45 years. This 1996 season should be distinctly more active than the recent inactive hurricane seasons of 1991-1994 or that of the average hurricane season of the last 25 years.

Coming Updated Forecasts

Later in 1996 updated forecasts will be issued on:

a) Thursday 6 June 1996, just after the official start of the hurricane season.

b) Wednesday 7 August 1996, just before the start of the most active part of the hurricane season.

These later forecasts utilize data closer in time to the hurricane season and should be somewhat more accurate than our late November and early April forecasts.

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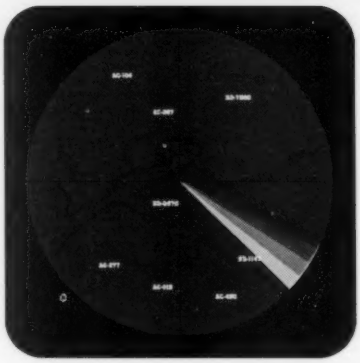
On the Bridge

J. Samuel Teel, Maine Maritime Academy

Most people have had the experience of losing the sense of what is happening around them while performing a specific task. Many people have experienced something similar when driving an automobile. The scenario might have happened like this. You were driving on the highway, three hours in to a seven-hour trip. The density of traffic had been steadily increasing. Driving conditions, particularly visibility, had decreased slightly in a light mist. Your mind was pondering some deep and remote thought, you were barely conscious of the traffic. Suddenly, you became aware that you had lost your concentration. You had no recall of the last few moments, and those moments might have been minutes. You had no specific memory of the landscape nor of the traffic that had passed by. You were aware of no definable details of what had been happening around you.

I have asked a number of mariners about the situation I just described; almost all will admit to having had the experience. Not just while driving, but also while standing a bridge watch at sea.



What they experienced is called loss of situation awareness. Situation awareness has become one of the bridge team management buzz words. Having it is good. Losing it is bad. An officer's level of situation awareness is a function of a variety of factors. Ability, training, experience, work load, working conditions, emotional stress, and bridge layout are just a few of the things which will impact your ability to keep track of what is going on.

The watch officer's cliche, "I didn't put her aground and I didn't hit anybody...," is really another way of saying that situation awareness was maintained throughout the watch. On the other hand, if you did run aground, then it would be a good bet that situation awareness was lost.

Mariners, by the nature of their work, are particularly susceptible to becoming distracted or complacent. Night watches, slow moving ships, and repetitive procedures stack up against the watch officer and his or her ability to maintain the desirable high level of situation awareness.

To avoid becoming a statistic, the watch officer must be constantly on guard. There is a simple formula that reads: Situation Awareness = Visual Input + ARPA Input + VHF Input. Although simple, it is a valuable tool that can be used to continuously self-critique your level of situation awareness.

Everyone is aware that during the course of a passage you have good periods and bad periods. There are times when things seem to go well and there are times when it seems that nothing works out correctly. Accordingly, there are a number of clues that a watch stander can look for that will indicate changes in his or her level of situation awareness. Some of these clues are: using undocumented or unplanned procedures; failure to meet targets and milestones; incomplete communications, either internal or external; ambiguity of information; fixation or preoccupation; professional intuition, that sense that something just isn't right.

What needs to be remembered is that in order for these clues to have any value, a watch officer must be working within the guidelines of a detailed passage plan. There must be a complete passage plan, with track lines, estimated times at various points along the track, margins of safety, no go areas, speed plan, and a communications plan clearly defining the intended passage.

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Hurricane Prediction

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Cautionary Note

It is important that the reader appreciate that these seasonal forecasts are based on statistical schemes which will fail in some years. These forecasts also do not specifically predict where within the Atlantic basin storms will strike. Even if 1996 should prove to be a somewhat average hurricane season, there are no assurances that many hurricanes will strike along the U.S. or Caribbean Basin coastline and do much damage.

A more complete explanation of this forecast with figures and tables is available on the World Wide Web at this URL: http://tropical. atmos. colostate.edu/forecasts/index.html.⚓

On the Bridge

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When an officer realizes or senses that something is out of the ordinary—in other words, not in accordance with the plan—the next thought that he or she should have is that situation awareness has been diminished. At this point, the most important thing an officer can do is to work to regain situation awareness. As an example, if the problem was related to the ship's position or lack of position on the chart, switch to a fix method that is unrelated to the ones in use. If that does not resolve the problem, communicate the fact to the next level of authority, the master. If you are in pilotage waters, the master will be readily available and should be kept fully informed.

If one or more of the clues becomes apparent to you, it may indicate the beginning of an error chain. An error chain is defined as a series of events that lead up to a casualty or accident. Loss of situation awareness is often the primary causal factor in the development of the error chain and furthermore, it is loss of situation awareness that hinders the watch officer's ability to capture the error and break the chain. To put it another way, if you don't know that something is wrong, you don't stand much of a chance of making it right!

An officer must complete a variety of tasks while standing a watch, the highest priority is to maintain a proper lookout in order to avoid collisions and unintentional close quarters situations. From a purely regulatory point of view, the flag states are not as interested in how you get from point to point as they are about proper application of the navigation rules.

Keeping the three components of situation awareness in mind will help to ensure that you will achieve and maintain a high level of situation awareness:

- Maintain a good lookout.
- Operate the ARPA in keeping with the guidelines established in the COLREGS, meaning systematic observation, long-range scanning, and overall application of good seamanship.
- Keep an ear tuned to the VHF radio, ready to glean any information concerning traffic movement in your area.

Then, put that information together. Cross check the information from one source against the other two. Be on guard for any ambiguity between the information. If your eyes and your ears tell you one thing and the ARPA something else, then resolve the reason for the ambiguous information and break the error chain. Do not simply discount the unmatched information. Find out why it does not fit with other inputs, then work to rectify the problem. It may be something as simple as looking at relative ARPA vectors when you thought they were set to true vectors. In any event, resolve the information discrepancy.

Situation Awareness =
Visual Input +
ARPA Input +
VHF Input

By using the visual, aural, and electronic inputs available to you, you should be able to increase your level of situation awareness and maintain a higher level of safe operation for yourself and your shipmates.

J. Samuel Teel is a Professor of Nautical Sciences teaching a variety of courses since 1982, including seamanship, celestial navigation, shiphandling, ARPA, RADAR, and Bridge Team Management. He is licensed as Master, Oceans, unlimited.

Professor Teel has worked aboard freighters and container ships and various supply and oil research vessels and is presently serving as the senior nautical science training officer for the Maine Maritime Academy's annual training cruise.

He is recognized as an expert in the field of maritime education with an emphasis in the realm of simulator training.⚓

Physical Oceanography

The "Physical Oceanography" column appears for the first time in this issue of the Mariner's Weather Log. In it we'll examine oceanographic phenomena that can affect a ship, whether it's on the high seas or in port. We'll look at phenomena such as waves, ocean currents, tides and tidal currents, storm surge, and seiche, to name a few, including the latest techniques for providing the observations and predictions of these phenomena needed by the mariner to make decisions affecting ship safety and efficiency. We encourage readers to send in questions that they would like answered. The easiest way is to send an e-mail to bruce@ceob-g30.nos.noaa.gov or a fax to (301) 713-4500.

Motion in the Ocean

Bruce Parker, Physical Oceanographer

The experience is fairly common for a physical oceanographer. Someone asks you what you do. You say you're an oceanographer. They ask if you study sharks or whales, or whether you ever met Jacques Cousteau. You say no, that you're a physical oceanographer. The look on their face shows that this means nothing to them. You explain that you study the physics of the ocean, in other words, all aspects of how the ocean moves—up and down like the tide or ocean waves, or horizontally like ocean currents such as the Gulf Stream. You see a faint sign of recognition when you mention the tide. They've been to the beach and seen it grow larger as the water slowly recedes. Of course, that doesn't spark the imagination like a great white shark or a giant squid.

The average person hears most often about biological oceanography—stories about dolphins and whales, diving on beautiful coral reefs, fish kills caused by a red tide, this year's fish catch and its effect on seafood prices, or the effect of water pollution on a bay's ecology. Stories about water pollution also involve chemical oceanography, as well as geological oceanography if there are pollutants in the sediments on the bottom of the bay. Geological oceanography also comes into play when a tourist beach erodes, or an underwater volcano or vent is discovered, or offshore mining or drilling takes place.

If, however, it was a mariner who happened to ask what you did and discovered that you were a physical oceanographer, the above conversation would have gone quite differently. The mariner understands the importance of physical oceanography. He deals with and reacts to physical oceanographic phenomena such as waves, ocean currents, tides and tidal currents, and storm surge on a daily basis.

In fact, physical oceanography finds its origins in the sailing and navigational needs of the earliest mariners. The earliest tide prediction schemes were considered cherished secrets in a sea trader's family and handed down from generation to generation. Ben Franklin's early maps of the Gulf Stream (based on reports of the drift of ships crossing it) allowed American ships to travel to England and return in several days less time than the British. In the mid-1800s Matthew Maury, an American naval officer, extended such analyses to the entire globe, deriving currents and winds from ships' log books and proposing shipping routes throughout the world's oceans.

A physical oceanographer studies the movement of water in the ocean (and in bays and harbors). He also studies the properties of water masses, primarily density as affected by salinity and temperature. These properties influence motion and can create motion. He may also study underwater acoustics (which is affected by these same properties). To explain motion in the ocean a physical oceanographer uses the mathematics of fluid dynamics. Because these equations are complicated to solve, he

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Motion in the Ocean

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uses powerful computers to solve them in the form of numerical hydrodynamic models. To get more data for his models he uses a suite of satellites as well as other instruments to provide measurements in real time. Some of these instruments use underwater acoustics to measure currents or make depth soundings.

What causes the waters of an ocean or bay to move? Once we have considered the important effect of the astronomical tide and the occasional tsunami due to an earthquake, just about every motion in the ocean can be traced back to the weather. The wind has the most dominant effect, but changes in atmospheric pressure, rainfall (leading to river discharge), air temperature, and even humidity can play a role. The ocean—and its heat content—in return, plays an important role in influencing the weather (and climate in general).

Thus, it is very appropriate that a column on physical oceanography should appear in the Mariner's Weather Log. Below are brief mentions of a whole assortment of physical oceanographic phenomena that a mariner faces, all of which have safety or economic consequences.

In the open sea, ship routing involves forecasting not only the marine weather and but also the local wind waves, as well as the waves that propagate large distances as swell. If a ship cannot avoid a stormy area with high sea state, it helps to know at least the direction, height, wavelength, and period of the waves so that the ship can change its heading and/or speed to minimize roll (or simply stop and drift, if necessary). On the other hand, following swell can increase a ship's speed toward its destination. There is also the possibility of a rare rogue wave doing real damage to a ship or even capsizing it. Such extreme waves are less rare in regions where large waves are increased in size by propagating against strong currents, or where the swell from two distant storms meet.

Since the days of Franklin's Gulf Stream maps, ships have tried to ride favorable currents and avoid unfavorable ones. Using satellite data and ocean model forecasts, some ships even try to take advantage of the rings that pinch off the meander of a major current like the Gulf Stream. Currents in high latitude waters move ice packs into shipping lanes. Fog is likely to occur where warm and cold currents are adjacent to each other (e.g. the Gulf Stream and Labrador Current), or over areas with upwelling (off southern California).

Vertical changes in water temperature and thus density can allow the generation of internal waves by a moving ship. So much of its forward energy can be used up by this internal wave generation, that the ship can be stopped dead in the water. When entering or leaving a port, water level (including the tide) becomes critical. Most large cargo ships and tankers cannot even enter U.S. ports except near the time of high water. To avoid running aground a pilot must have accurate water level information and cannot rely only on a tide prediction, which does not include the effects of wind. If the water level is higher than the tide prediction, a ship may either be able to leave earlier or load more cargo.

The currents in the entrance to a port and in its shipping channels are also important. Most large ships cannot maneuver unless the currents are below some critical value. In some narrow waterways, right of way must be given to the ship with the "fairtide," because the ship moving with the current has less maneuverability. Wind and river effects must be considered, in addition to the tidal currents, for the information to be accurate enough. This same current information is also important in predicting the movement of oil spills (so that they can be cleaned up more efficiently) and the movement of life rafts in search and rescue operations.

Water density in a port determines how low a ship will sit in the water. If spring freshets in a river decreases the salinity and thus the density of water, a ship leaving a port will have to carry less cargo. Horizontal salinity/density differences up an estuary generate gravitational currents.

A harbor has a natural period of oscillation based on its length, width, and depth. When offshore wind and wave conditions are right, some are prone to seiching, which can do damage to ships at dockside.

As a ship enters a port, nautical charts are critical. Sonar uses underwater acoustics to measure water depths, which end up as soundings on the chart. Acoustic doppler current profilers work by the same principle, as do doppler radar used for weather/wind measurements on land. Acoustic propagation in water is affected by vertical temperature stratification, and especially by layers of plankton, which have been critical to submarines who wish to evade sonar detection.

In this column we will try to provide some understanding of physical oceanographic phenomena. We will also look at the latest techniques for providing the mariner with the observations and predictions of these phenomena that he needs to make decisions that affect the safety and efficiency of his ship.⚓

Barnacles and Blennies: Diversity in a Dockside Habitat

Ramona Schreiber, National Marine Fisheries Service

At first glance, that piling beneath the pelican doesn't seem like an appealing place for anything to live. But take a second look; what you'll see is sure to be a surprise. Piers and pilings provide an interface between the marine and the terrestrial environment that's easily accessible yet often ignored. This oversight is unfortunate, as just inches from the beaten path is a window on marine diversity. It's likely to be covered with marine life as varied as a rocky shore, seagrass meadow, or a coral reef habitat. What do we mean by habitat? Habitat is the place in time and space where organisms live. Piers provide an excellent habitat for a number of organisms. From sessile barnacles to highly mobile fish, a multitude of animals co-exist on these structures. Here's a quick run-through of the typical animals and plants—from algae to recreationally important fish, from the top of the post to the surface of the substrate—you're likely to find.

The uppermost zone of this piling structure is a constantly changing environment. Partially exposed to air, sun, and wind, organisms living there must be well adapted to the fluctuating conditions. They must endure periods of drying as well as prolonged submersion as the tides rise and fall over the course of the day. Likewise, the effects of storm surge and waves require the organisms to be able to hold fast to their substrate. What organisms would you expect to find here?

Barnacles do extremely well in this transition zone. From the phylum *Arthropoda*, these attached organisms are well adapted to the scouring effects of currents, and they exist in this environment by standing on their "heads." Barnacles "stick" to the pier using a glue-like material that is excreted during development and attachment is at their "heads." This cementing material is so strong that scientists considered its use as a potential adhesive in dental appliances. Barnacles are composed of a four-plate lid that opens and closes according to the prevailing environment. At low tide, when the organisms are dry, the lid closes tightly and seals the body within the shell, protecting it from desiccation. Once immersed as the tide rises, the barnacles open their lids and expose small filaments (their "legs") to the water column in order to collect food. As filter feeders, barnacles use these filaments to sieve fine materials from the water column. The life cycle of the barnacle is an interesting one. The life stage we are familiar with is the adult form, commonly found attached to pilings (or virtually anything else within the marine environment). The larval stage, however, is quite different. Once released from the adult, planktonic larvae (called cyprids) disperse throughout the water column and distribute everywhere. The larvae eventually settle out and attach themselves using their specialized cementing material. They may attach to piers, rocks, boat hulls, even crabs, fish, whales, and turtles. Where a current can be found, barnacles may find their way to set up a new colony. Boatsmen are familiar with the damage these fouling organisms can cause to any vessel. Removal of these fouling communities can result in substantial expenses for the mariner.

Other organisms that compete for this transition zone include mussels and limpets. The mussel, a bivalve mollusk, is similar to the barnacle in that it is able to seal its moist body within its shell when exposed to heat and drying. Limpets, another mollusk, are also filter feeders that possess an attached lifestyle in this zone. Land-based organisms such as the isopod *Ligia* dart across this habitat during exposed periods of the day. The rough edges and crevices of barnacles and mussels provide ideal places for algae, detritus, and other materials to settle on, a place that the isopods often find appealing.

Moving downward to the submerged habitat of this piling, a wealth of diversity exists. Barnacles and mussels continue to cover the surface, but are now intermixed with other attached organisms. The urochordates such as the ascidian *Styela,* or sea squirt, actively filter the water column for food sources. Sponges, Phylum Porifera, also exist in this stationary habitat and filter nutrients and plankton from the water column. They use a pumping system that is rather interesting and unexpected. Water is drawn through pores that are easily visible. Inside, choanocytes, or collar cells have flagellated tails that beat methodically creating a current to filter food. Water is then pushed out through osculum, or excurrent openings in the organism. Thus, this simple looking animal is much more complex that you might expect. The appearance of bryozoans, "moss animals," may fool you on first glance to think that they are plants. On closer inspection, however, these organisms have microscopic feathery tentacles that emerge and retract to collect bits from the water column. The tips of the tentacles on the brown sea moss *Bugula* have structures called avicularia, which function as a defense against predators. This structure is the shape of a bird's head and beak, complete with jaws to grasp

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Barnacles and Blennies

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organisms for food, as well as to keep larvae from settling on and fouling the organism.

Colonial hydroids are often associated with many habitats, including piers and piling structures. They attach themselves by way of holdfasts. A stem laden with polyps comprises the body, and tentacles wave from the polyps, each covered with an interesting defense mechanism. Nematocysts, or microscopic barbs, are effective in stinging predators, prey, or any passerby that happens too close. This defense, however, also provides a safe habitat for other species, such as nudibranchs and snails, that have adapted to live among the deadly stingers and feed on materials that flow through their paths.

Moving around these colonial organisms are a plethora of grazers, including snails, starfish, anemones, and small fish. The periwinkle snail, *Littorina irrorata*, is a voracious grazer. The snails move about the barnacles feeding on algae and other plants attached to the piling. Some species are able to graze on vegetation such as the leathery dull-green seaweed, *Fucus*, that grows within this habitat. Others, such as the limpet, depend on the seaweed for food as well as shelter from predators. Other inhabitants in this zone include xanthid crabs and snapping shrimp. These decapod crustaceans feed on plant matter as well as larvae and small oysters available within this microcosm.

Like rocky shores, jetties, and coral reefs, the pier pilings provide a valuable relief that is essential for several species of small fish. Blennies and gobies dart in and out of their small niches, hiding among colonies of hydroids from predators and waiting for their own prey, such as small crustaceans. Coral polyps and algae are also food sources for these small fish. Under close examination, these fish appear to play a never ending game of hide and seek. Larger fish make special use of pilings as a lucrative food source. Blennies, gobies, crabs, and shrimp are easy pickings for sheepshead, drum, and other opportunistic feeders. A fishing line near any pier is sure to bring a bite by a number of fish in no time.

The next time you notice gulls peering from their piling perches into the water below, you'll know the reason those pilings are prime real estate. With a wide variety of algae, crustaceans, and fish just below the surface, the gull is probably spying its next meal. Likewise, the school of sheepshead you see circling through the pilings is dining on a fine meal of crab, shrimp, or blennies readily available on these structures. This diverse assemblage that lives attached and adjacent to pilings is a window on the marine ecosystem that's interesting and easy to observe along our everyday paths.

Ramona Schreiber is a fisheries biologist for the Office of Habitat Protection, National Marine Fisheries Service, in Silver Spring, Maryland. *Special thanks to Loren Coen of the South Carolina Department of Natural Resources Marine Resources Research Institute for review of this article.*⚓

New Mariners' Museum video and electronic postcards™ highlight the popular Crabtree Collection of Miniature Ships

Newport News, VA —A videotape and a set of electronic postcards™ produced by The Mariners' Museum highlight the Crabtree Collection of Miniature Ships, one of the Museum's most popular exhibits. The collection of 16 miniature vessels representing the development of sailing ships reflects 28 years of intensive effort and craftsmanship by artist-carver August F. Crabtree. Each tiny vessel is constructed in the same way its full-size counterpart was built, with hull framed and planked and rigging operable.

The 20-minute video, available for $19.95, recounts Crabtree's career, showing the artist working with tiny dental and surgical tools to craft models out of pear, apple, laurel, and lime woods. Close-up views of each miniature ship reveal the intricate details and painstaking authenticity that were the hallmark of Crabtree's work. The video is based on extensive new research as well as interviews conducted with Crabtree before his death in 1994. Production of the video was made possible by a grant from the Franklin O. Blechman Memorial Trust.

A two-disk set of electronic postcards™ about the Crabtree miniature ships is also available in the Museum Shop for $10. The computer disks contain detailed views of each ship along with extensive descriptions of the vessels' history and construction. The disks require an IBM compatible computer with DOS or Windows and a VGA color monitor capable of 256-color display. A mouse is recommended but not required.

Located adjacent to the Museum's main entrance, The Museum Shop is open Monday–Saturday from 10 a.m. until 5:30 p.m. and Sunday from noon until 5:30 p.m. To place a mail order, please call the Museum Shop at (804) 591-7792 or (800) 259-3916.⚓

Voluntary Observing Ship Program

Martin S. Baron
National Weather Service

New Publications And Observing Aids

A number of outstanding new materials are available for observers aboard Voluntary Observing Ships (VOS). These include: (1) a new National Weather Service (NWS) Observing Handbook No.1, Marine Surface Weather Observations; (2) a new wall poster "Ships Weather Code;" (3) a new booklet "Guide To Sea State, Wind, and Clouds;" and (4) a video, "VOS, Voluntary Observing Ship Program, How Ships at Sea Collect Marine Weather Data." These are all available from NWS Port Metrorological Officers. Copies of the observing handbook and video were mailed to all NWS VOS program vessels during April 1996.

The new observing handbook was designed in a compact six by nine inch size, and is formatted like a naturalists field guide for easy reference. It has a comb binder which allows it to open flat. The wall poster is 23" by 31", and was designed to complement the Ships Code Card. It is a quick reference to the Ships synoptic code and code tables. Please hang it up on the bridge if you have wall space available. The Sea State/Cloud booklet has 14 sea state photos and 54 cloud photos, complete with captions and explanations.

To produce the VOS program video, we hired a video production company, Walkabout Productions, Inc., of Annapolis, Maryland. We were also privileged to have Robert Amdur, NOAA media director, serve as producer. Much of the footage was taken aboard the Sealand Consumer, under the watchful eye of Captain Fred Cook. We thank him and his staff for their cooperation and hospitality. We also thank Sealand Service operations manager Sam Oncea for making the production possible by granting us access to the vessel.

Voluntary Observing Ship Awards For 1995

I am pleased to announce that 57 vessels will receive awards for outstanding cooperation and support as weather observers during 1995. We thank these vessels for their extraordinary efforts. All Voluntary Observing Ships make important contributions. We regret that only a small number of vessels can be honored with an award. The 1995 award winners are:

Acadia Forest
Alligator Excellence
Almania
Anna Maersk
Argonaut
Arktis Light
Arthur M. Anderson
Bernardo Quintana A
Burns Harbor
California Current
Charles Lykes
Columbia Bay
Columbine
Courtney Burton
Denali
DG Columbia
Edelweiss
Edyth L.
Freja Svea
Gulf Current
Handy Logger
Havelland
ITB Groton
James R. Barker
Kinsman Independent
Marie Laura
Marie Maersk
Maui
Melville
Mosel Ore
M/V Bellona
Nomzi
Norway
NOAA Ship Townsend Cromwell
Oleander
President Eisenhower
President F.D. Roosevelt
Roger Blough
Robert E. Lee
Sealand Atlantic
Sealand Enterprise
Sealand Hawaii
Sealand Integrity
Sealand Navigator
Sealand Trader
Sea Trade
Seaward Johnson
Senator
S/S Guayama
Strong Cajun
Sven Oltmann
Tillie Lykes
Tyson Lykes
Torm Freya
Western Lion
Westwood Annette
Yuri Ostrovskiy

Hurricane Season

The northern hemisphere hurricane season runs from June through November. Vessels must exercise special vigilance during this period. **Voluntary Observing Ships are asked to report weather once every three hours when within 300 nm of named tropical storms or hurricanes**.

Your swell observations provide particularly important information about tropical storms. The appearance of a heavy, rolling, swell often indicates a tropical storm some distance away. Such swell are the remains of huge, decayed waves generated by the storm, but traveling faster than the storm. If the storm is approaching, swell will become higher with less rounded (less regular) crests. The

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VOS Program

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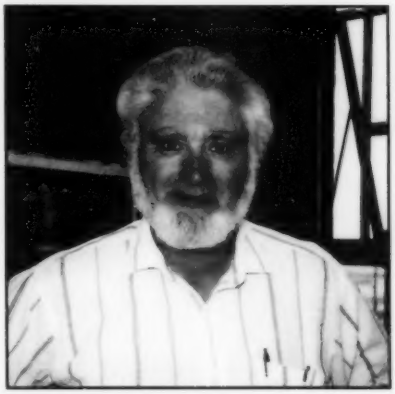
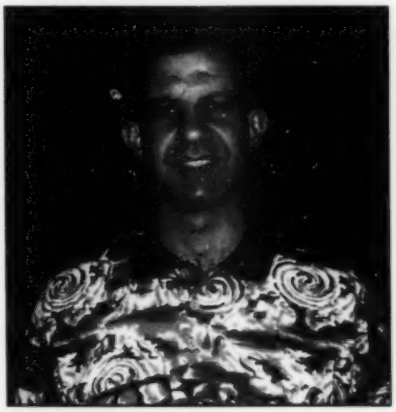
swell period will decrease. Clouds will lower and thicken, pressure will fall, wind speed will increase, and weather conditions will deteriorate.

New PMOs

The Big Apple Has Full Compliment of PMOs



Tim Kenefick



Pete Gibino

For the first time in a couple of years, New York and Newark each have a Port Meteorological Officer assigned. The effort started when Tim Kenefick accepted the position of PMO for New York City in August 1995, and reported in September. Almost immediately, John Bollinger accepted a Hydro-Met Tech Position In Louisville, Kentucky, and by the 10th of October, Tim had the conn.

Tim's solo performance has recently turned into a duet with the addition of Pete Gibino, who reported aboard from Huntington, West Virginia, on the 4th of March.

Between the two, they have worked in weather for half a century, with nearly 15 years of providing weather support while at sea.

Their goal is to put forth a cooperative effort in serving the merchant fleets calling on New York, New Jersey, southern New England, and Philadelphia/Camden. If they miss you, it is hoped that one of their brethren elsewhere will serve you.

If you are preparing to make a port call in the northeast and are in need of any weather supplies or equipment inspections, you may fax your requirements to us at (201) 623-8771. State who you are, where you will be, when you will be there, and what you need. Please include your agent's phone and fax numbers.

Also, if you are in a foreign VOS program, state which program you are in and form numbers for that program.

New Recruits January–March 1996

During the three-month period ending March 31, 1996, PMOs recruited 84 vessels as weather observers/ reporters in the National Weather Service (NWS) VOS program. Thank you for joining the program.

Please follow the worldwide weather reporting schedule as best you can—report weather four times daily at 0000, 0600, 1200, and 1800 ZULU or UTC time. The United States and Canada have a 3-hourly weather reporting schedule from coastal waters out 200 nm from shore, and from anywhere on the Great Lakes. From these coastal areas, please report weather at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 ZULU or UTC, whenever possible.

To transmit your weather report to the NWS, use:

(1) INMARSAT Standard A or Standard C.

(2) U.S. Coast Guard Simplex Teletype Over Radio (SITOR), or plain language (recite the coded message using radiotelephone).

(3) Commercially operated shore radio stations (using SITOR or CW), as a back-up, if methods (1) or (2) are not available.

See Chapter 3 of the new NWS Observing handbook No.1 for more details about transmitting your weather reports.

Reminder On Loaned Equipment

Meteorological equipment supplied to vessels—barometers, barographs, sling psychrometers, wind wheels, and sea-water bucket thermometers are **loaned** to VOS program vessels taking weather observations. The equipment is expensive and hard to replace. Please contact your PMO whenever your status as a VOS program participant is about to change. If you are no longer taking part in the program, an equipment pick-up, drop-off, or delivery will be needed. Equipment supplies are very

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VOS Program

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limited. Please help ensure that equipment is accounted for and available for new recruits.

Report Accurate Data

It is of utmost importance to ensure that your equipment is accurate and properly calibrated. A PMO should calibrate your barometer and barograph once every three months, and also check your psychrometer during every ship visit.

Sea-water thermometers (whether hull-mounted or located in the condenser intake) should be calibrated annually, and checked every time your vessel is in the yard for service. If your vessel has an anemometer, it should be calibrated once every six months. Make sure the anemometer is located where the ships superstructure will not interfere with the air motion. When recording dry and wet bulb temperatures, always take your psychrometer to the windward side of the ship. This allows contact with air fresh from the sea which has not passed over the deck prior to your measurement.

When observing and recording data, always proceed in a very careful and meticulous manner. An inaccurate observation can be very misleading to the forecaster.⚓

National Weather Service Voluntary Observing Ship Program

New Recruits from 01-Jan-96 TO 31-Mar-96

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
ANNA CATHARINA	DJSY	TROPICAL SHIPPING CO.	MIAMI, FL
APL PHILIPPINES	V7AM2	IWD	SAN FRANCISCO, CA
APL SINGAPORE	V7AL8	AMERICAN PRESIDENT LINES	SEATTLE, WA
APL THAILAND	V7AL9	IWD	SAN FRANCISCO, CA
ASPILOS	9HNE4	ASPILOS SHIPPING CO., LTD	SEATTLE, WA
ASTRO MERCURY	3EYG5	KAMBARA MARINE CO., LTD	SEATTLE, WA
ATLANTIC BULKER	3FSQ4	SHOWA LINE ENGINEERING CO. SAKURADA BLDG.	MIAMI, FL
BLEST FUTURE	DUHE	KOYO LINE LTD, 6F HITOTSUBASHI CTR BLDG.	SEATTLE, WA
BOW TRIGGER	3FOT3	J. E. ASPEN SHIPPING CO	NEW YORK CITY, NY
CAMELLIA ACE	3FSD4	AUTOLINERS INC.	NEW YORK CITY, NY
CARI-SUN	V2AJ9	TROPICAL SHIPPING CO	MIAMI, FL
CARIBBEAN MERCY	3FFU4	MERCY SHIPS	MIAMI, FL
CHEVRON SOUTH AMERICA	ZCAA2	CHEVRON SHIPPING CO	NEW ORLEANS, LA
CORMORANT ARROW	C6IO9	JARDINE SHIP MANG., LTD	SEATTLE, WA
COSMIC CHALLENGER	DUXY	ALBAR SHIPPING AND TRADING CORP.	SEATTLE, WA
CTE ALGECIRAS	V2AL5	HARRINGTON & CO.	MIAMI, FL
DIRECT FALCON	C6MP7	AUSTRALIA-NEW ZEALAND DIRECT LINE	LOS ANGELES, CA
EDCO STAR	SSLB	MISR EDCO SHIPPING CO. S.A.E.	SEATTLE, WA
EVER REFINE	3FSB4	EVERGREEN AMERICA CORP	NEW YORK CITY, NY
EVER REPUTE	3FRZ4	EVERGREEN AMERICA CORP	NEW YORK CITY, NY
EVER REWARD	3FYB3	EVERGREEN AMERICA CORP	NEW YORK CITY, NY
FMG CARIBE	DNPX	FAROVI SHIPPING CORP.	MIAMI, FL
FULL COMFORT	VRUO8	COSCO (H.K.) SHIPPING, LTD	SEATTLE, WA
GOLDEN LADY	9HCO4	EASTERN MEDITERRANEAN MARITIME LTD	MIAMI, FL
HANDY BRAVE	DVPA	FIRST EASTERN SHIPPING CO., LTD	SEATTLE, WA
HANJIN SINGAPORE	D9TX	HANJIN SHIPPING COMPANY	LOS ANGELES, CA
HANJIN TOKYO	3FZJ3	HANJIN SHIPPING CO., LTD.	NEW YORK CITY, NY
HERACLITUS	V3MK2	PLANETARY CORAL REEF FOUNDATION	HOUSTON, TX
HIGHGATE	3ELJ8	OCEANS INTERNATIONAL	HOUSTON, TX
HOEGH MERIT	C6IN3	HOEGH FLEET SVC, A/S	SEATTLE, WA
IBN SINA	9VDL	UNITED ARAB AGENCIES	NORFOLK, VA
KELLIE CHOUEST	KUS1038	MASTER-KELLIE CHOUEST	NORFOLK, VA
LEGEND OF THE SEAS	ELRR5	ROYAL CARIBBEAN CRUISES LTD/MARINE OPS	MIAMI, FL
LINDA OLDENDORF	ELRR2	JOHN S. CONNOR, INC	BALTIMORE, MD

National Weather Service Voluntary Observing Ship Program

New Recruits from 01-Jan-96 TO 31-Mar-96 (Continued)

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
LOS RIOS	HCZW	ECUADORIAN LINE	MIAMI, FL
LUMINOUS ACE	DZSA	PMO NEW YORK	NEW YORK CITY, NY
MAERSK CHARLESTON	ELRO2	MAERSK INC.	NEW YORK CITY, NY
MAERSK NEWARK	9XVR	MAERSK, INC	NEW YORK CITY, NY
MAERSK TANJONG	9VEB	A.P. MOLLER SINGAPORE PTE.LTD	SEATTLE, WA
MAHARASHTRA	VTSQ	SHIPPING CORPARATION OF INDIA, LTD	SEATTLE, WA
MAJESTY OF THE SEAS	LAOI4	ROYAL CARIBBEAN CRUISES LTD/MARINE OPS.	MIAMI, FL
MALMNES	LAQX4	BARWIL-ASCA MARINE INC.	NEW YORK CITY, NY
MARINE EXPRESS	TCXS	SEMIH SOHTORIK MANGAGEMENT AGENCY	SEATTLE, WA
MING STAR	BLHV	SOLAR INTERNATIONAL SHIPPING	LOS ANGELES, CA
MINT BRISK	C6CV8	ELLER & CO.	MIAMI, FL
NEW VENUS	3EPV4	SHEN SHOU-JOHN	SEATTLE, WA
NORTH SEA	C6RN	ECUADORINA LINE, INC.	MIAMI, FL
NOSAC TAKARA	ELFQ2	BARBER SHIP MANAGEMENT AS	BALTIMORE, MD
OCEAN JADE	DUTA	OCEAN TRADE LINE, S. A. TOKYO OFFICE	SEATTLE, WA
OCEAN SERENE	DURY	VICTORIA SHIPPING, INC	SEATTLE, WA
OJI PIONEER	ELMP3	KYOKUTO SHIPPING CO., LTD, MITSUI BLDG NO.3	SEATTLE, WA
OLYMPIAN HIGHWAY	3FSH4	KOBE NIPPON KISEN KAISHA, LTD	SEATTLE, WA
OMI COLUMBIA	KLKZ	OMI CORP	SAN FRANCISCO, CA
OOCL AMERICA	ELSM7	OOCL (USA) INC.	SAN FRANCISCO, CA
OOCL CALIFORNIA	ELSA4	OOCL USA INC.	SEATTLE, WA
ORCHIS ISLAND	3EFJ5	IINO KAIUN KAISHA, LTD, IINO BLDG	SEATTLE, WA
ORIENTE NOBLE	3FVF5	RAINBOW MARITIME CO., LTD. KOBE YUSEN BLDG.	SEATTLE, WA
PACIFIC ESCORT	NGEL	MASTER CODE 1219E	NORFOLK, VA
PACIFIC HIRO	3FOY5	ORIENT MARINE CO., LTD. INAOKA KUDAN BLDG. 4 FLR SEATTLE, WA	
REPUBLICA	HCRE	ECUADORIAN LINE	MIAMI, FL
RITA	DGNR	TROPICAL SHIPPING CO	MIAMI, FL
RUBIN BONANZA	3FNV5	TOYO SANGYO CO., LTD, 2263-58 KO, NAMIKATA	SEATTLE, WA
RUBIN ROSE	ELML4	NAVIX LINE CO.,LTD	SEATTLE, WA
SAN MIGUEL	P3XC5	IVARAN AGENCIES INC., NEWPORT FINANCIAL CTR	NEW YORK CITY, NY
SAUDI RIYADH	HZQT	U.S. NAVIGATION-ROOM 200	NORFOLK, VA
SEALAND GUATEMALA	OVJV2	BRANDTSHIPS	MIAMI, FL
SEALAND MERCURY	V7AP6	SEALAND SERVICE INC	SAN FRANCISCO, CA
SEALAND METEOR	V7AP7	SEALAND SERVICES INC	SEATTLE, WA
SEALAND RACER	V7AP8	SEALAND SERVICE INC	SEATTLE, WA
SIETE OCEANO	DYBX	IMECS CO. LTD, NXB BLDG. 6TH FLR	SEATTLE, WA
SINGAPORE EXPRESS	ELPM9	HAPAG-LLOYD (AMERICA) INC.	NEW YORK CITY, NY
SOLAR	WJLP	AMERICAN HEAVY LIFT	NEW ORLEANS, LA
SOLDROTT	LAQD2	BARWIL-ASCA MARINE, INC	NEW YORK CITY, NY
SPLENDOUR OF THE SEAS	LAUS4	ROYAL CARIBBEAN CRUISES LTD/MARINE OPS	MIAMI, FL
STAR HERDLA	LAVD4	A/S BILLABONG	BALTIMORE, MD
STEPHAN J	V2JN	ELLER & CO	MIAMI, FL
STOLT EAGLE	D5VG	SAGA (USA) INC	NEW YORK CITY, NY
STOLT HELLULAND	ELJZ7	SAGA (USA) INC	NEW YORK CITY, NY
STOLT JADE	ELEG5	SAGA (USA) INC	NEW YORK CITY, NY
SUPER RUBIN	DYAI	NAVIX LINE LTD.	SEATTLE, WA
TROOPER	WCC4013	ALASKA DEPT OF PUBLIC SAFETY, MARINE SVCS	KODIAK, AK
USNS RAPPAHANNOCK TAO-204	NRAP	MASTER	SAN FRANCISCO, CA
WADI SUDR	SSHX	NATIONAL NAVIGATION CO.	SEATTLE, WA
WOLDSTAD	WZHC	ALASKA DEPT OF PUBLIC SAFETY, MARINE SVCS	KODIAK, AK

VOS award presentation to the vessel Frances L. *Left to right: 2nd Officer Paulino Enriquez, PMO Jim Saunders of Baltimore, Maryland, and Capt. John Gladstone.*

The crew of the Pride of Baltimore *displays the VOS award presented to their vessel. The* Pride of Baltimore, *which is a sailing ship, is a goodwill ambassador sponsored by the state of Maryland, and sails around the world.*

Pictured from left to right is Cleveland PMO congratulating Captain George O. Herdina, 3rd mate John McNabb, and 2nd Mate Francis Leckie of the vessel Str. Medusa Challenger. *Not pictured are 1st Mate Raymond Groh, 1st Mate Relief Captain Harry Tressa.*

Cleveland PMO George E. Smith presents a VOS award to 1st Mate Conrad Gilliam and Captain Mitchil B. Hallin of M.V. Paul R. Tregurtha. *Not pictured are Eugene Christionson, Mike LaCombe, and Kevin Johnson.*

Martin Bonk, Norfolk PMO, presents a VOS award to Captain Edwards, Master of Strong Cajun.

A welcome aboard VOS plaque was presented to the vessel Westwood Halla *for being recruited into the VOS Program. Pictured left to right are PMO Pat Brandow, Captain Erwin Thiele, and Radio Oficer Maximo Lopez.*

The USCGC Polar Sea *took one of the top honors for outstanding observations for 1994. Left to right: ENS Sean Carroll, MST3 Chapin Piper, MST2 Noell Bolleurs, and MST3 William Walters. The award plaque was presented by PMO Pat Brandow of Seattle.*

Richard Griffith, VP Marine Operation of Totem Ocean Trailer Express (TOTE) *of Tacoma, WA, accepts an award from Seattle PMO Pat Brandow. TOTE always goes above and beyond the call of duty when sending timely weather observations from a very important route, between the Pacific Northwest and Alaska.*

SEAS and AMVER: Entering the 21st Century

Chris Noe

NOAA operates the *Shipboard Environmental data Acquisition System (SEAS)*, a global Volunteer Observing Ship program, for the real-time collection of oceanic and surface marine data. The next generation SEAS now being implemented effectively merges NOAA's environmental data collection efforts with the U.S. Coast Guard's *Automated Mutual-assistance VEssel Rescue (AMVER)*, global safety program. A vital link in the integration of these programs is the Standard C service offered by COMSAT.

The SEAS data which includes position, are collected by dedicated volunteers and transmitted in real-time via a GOES or Standard C transmitter to NOAA headquarters for use in the operational weather and climate forecast models and for worldwide exchange.

The AMVER program quickly provides accurate information on the positions and characteristics of vessels near a reported distress to the search and rescue authorities. AMVER data is provided voluntarily by vessels in four types of reports. The Sail Plan, Position, Deviation and Arrival Reports contain information on departure, destination, deviations from original plan and position within 25 nautical miles. These reports are transmitted to the U.S. Coast Guard via Standard C transmitters.

COMSAT links these two programs with their Inmarsat Standard C services. COMSAT satellites provide global coverage which allows the Standard-C service to relay real-time data from ships worldwide. The next generation SEAS/AMVER software compresses the shipboard messages and transmits them via Standard-C at a fraction of the current costs. The benefits are many for commercial ships involved in collecting weather observations and submitting AMVER reports via this software. If the ships have INMARSAT STD C these benefits include:

- No cost to the ship for either weather or AMVER Reports.
- SEAS weather reports are converted to AMVER position reports and forwarded to the Coast Guard thus eliminating the need for the ship to create separate position reports.
- Extensive error checking to improve the quality of reports.

In addition, the SEAS/AMVER programs benefit by:

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Captain Glenn D. Strathearn (L), Master of the Sea-Land Atlantic, *receives a 1995 award for excellence in taking and transmitting VOS observations from Houston PMO Jim Nelson.*

Chief Mate Jim Crowley (L) and Captain Peter Poulnot (R) of the Tug Columbia Bay *show their 1995 award for excellence to Houston PMO Jim Nelson. Interestingly enough, the* Columbia Bay *took well over 700 observations in 1995, more than two times the observations taken by the vest majority of ships in the VOS program. WELL DONE!*

SEAS and AMVER

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- Ability to use the ship's equipment (PC and/or Standard C transceiver) to support the system.
- More reliable error checked communications.
- Reduced cost by transmitting compressed messages.
- Two-way capability so that the SEAS office can contact observers in case of problems.

EVERYBODY WINS!

Extensive testing of the new SEAS/AMVER software was performed by the captain of the NOAA ship Malcolm Baldrige, Craig Nelson during their recent year long, around the world cruise. Capt. Nelson contacted the SEAS headquarters regularly to report problems and inconsistencies in the software. After several months of testing and correcting the software, Capt. Nelson has been successful in entering and transmitting messages worldwide. His success has led the deployment of the beta-test version on approximately twenty other test ships. Test results from these ships are expected in the Spring of 1996 and final implementation is expected in the Summer of 1996.

Next generation SEAS/AMVER combines two very important programs into one easy to use software package. Participants in these programs both contribute to the global effort to determine the ocean's role in climate change as well as promote the safety of life and property at sea. To learn more about these programs and how to become a participant, contact Chris Noe at SEAS headquarters in Silver Spring, MD at (301) 713-2790 or by e-mail at cnoe@nos.noaa.gov.⚓

Sea State Products

Lee Chesneau
Marine Forecast Branch

One of the greatest hazards to a vessel's safety are dangerous sea state conditions. Masters are responsible during transoceanic crossings with crew safety and ensuring that the ship and its valuable cargo arrive at destination ports intact, while meeting tight schedules. Since the turnaround time in each port is usually less than 24 hours, the duration of encounter for adverse or slowing seas must be minimized.

The Marine Forecast Branch (MFB) issues one surface analysis a day for each ocean (12Z in the Atlantic Ocean and 00Z in the Pacific Ocean) and two 48-Hour Sea State Forecasts each day. The analyses are prepared using ship reports and plotted in meters, along with reported primary swell direction. The data is overlaid with a 12-hour surface pressure forecast from the previous forecast model run which is valid at either 00Z or 12Z, the same time of the reported observation. The analyst also has a short range significant wave height forecast (12 hours) from the US Navy and NOAA as guidance. From the same 00Z and 12Z forecast model guidance, 48-hour significant wave forecasts are prepared and disseminated. The Sea State analyses and Forecasts, when viewed with the same synoptic Surface Analyses and 48 Hours Surface Forecasts, help vessels make timely course and speed adjustments to avoid hazardous conditions and minimize exposure to slowing conditions.

Sea State Analysis

This product is generated once a day per ocean (12Z for the Atlantic and at 00Z for the Pacific) and depicts solid contour intervals of 1 meter along with primary swell direction arrows. Where appropriate, maximum and minimum combined wave height values (approximately 1/3 the height adjacent to the maximum or minimum values. The primary swell direction arrows are based on ship observations. Ship reports are viewed along with the Navy and NOAA significant wave forecast models as a first guess for contour guidance. The Sea State Analyses highlight areas of significant combined sea and swell wave heights. During the winter, the ice edge is depicted as a bold jagged line. When viewed together with the surface analyses, the user has a complete picture of surface weather conditions in a timely manner.

48-Hour Sea State Forecast

These forecast products are generated from 00Z and 12Z for each ocean and will be valid at 00Z and 12Z. The forecasts are based on the forecast model runs from the Navy and NOAA. The combined sea heights are depicted in solid contours of 1 meter increments with maximum or minimum combined sea state values underlined with the abbreviation of "MAX" or "MIN" under or adjacent to the values. Also, the ice edge is displayed as a bold jagged line during the winter. Similar to the Sea State Analyses, these products provide a complete picture of forecast surface conditions when used in conjunction with the 48-Hour Surface Forecasts. The 48-Hour Sea State Forecasts highlight areas of significant combined sea and swell wave heights. Issued in a timely manner, the 48-Hour Sea State Forecasts significantly aid in the independent decision making process of heavy weather avoidance and thus minimize the duration of encounter with slowing or potentially damaging conditions.⚓

Familiarization Float On Banda Seahorse

Greg Matzen, MPM, NWS Alaska Region

Russ Page, Ice/Sea Surface Temperature Meteorologist from the Anchorage Forecast Office, and Greg Matzen, Regional Marine Program Manager from the National Weather Service Alaska Region took a familiarization float aboard the Tidewater, Inc., Marine Services M/V Banda Seahorse on February 27, 1996. The Banda Seahorse is an oil industry service ship. It is 204 feet long and about 300 gwt, generating 5,000 hp from its twin diesels. It is operated by Tidewater, Inc., crews on contract with Cook Inlet Spill Prevention and Response, Inc. (CISPRI) of Kenai. The vessel is on continuous patrol in Cook Inlet in case of any oil spill. The ship has an ice-rated haul in order to operate in Cook Inlet during the winter months. The Skipper for this trip was Dave Gubert. Dave has over 25 years of experience at sea, mostly in the oil services industry. He has worked in North Sea, Gulf of Mexico, and Alaskan waters.

Russ and Greg joined an interagency group of representatives from the NOAA Safety of Navigation Project for Cook Inlet. The purpose of the trip was threefold: (1) to observe the sea ice in Cook Inlet with respect to tidal movement; (2) to see how well the ship could maneuver in sea-ice conditions; and (3) to discuss the importance of marine weather observations with the group and the crew.

The ship departed from the dock at Nikiski near Kenai and headed north-northwest toward the oil platforms. The vessel circled the southernmost platforms, then headed south and returned to the Nikiski Dock west of the town of Kenai. During the trip, the vessel penetrated first year ice in various thicknesses most of the way. The vessel stopped several times to allow the group (and Russ) to view and touch the ice. The vessel was able to penetrate ice up to about 4 feet thick before being halted and having to back out of several spots. On the return trip, we pulled alongside of the Shell A platform within about 75 yards for a close look at how large the platforms are.

The ship has no weather observing equipment aboard other than an outside thermometer. It is equipped with an INMARSAT unit and a cell phone.

Russ and Greg discussed the importance of weather observations, including sea-ice conditions, with Skipper Dave Gubert and his chief engineer. Russ and Greg also discussed the value of marine weather forecasts for Cook Inlet with Skipper Gubert. He shared the following with respect to Anchorage NWSFO marine forecasts and sea-ice forecasts: The marine weather conditions can, and often do, vary dramatically from lower Cook Inlet, south of Kalgin Island and upper Cook Inlet, north of the Forelands. They listen to the forecasts broadcast over Marine VHF Radio Homer and Anchorage. Skipper Gubert said sometimes the broadcast will mention several lows affecting a particular area with movement here and there. He said it is very difficult to understand and interpret what is expected to happen; in other words, confusing. Skipper Gubert said the highest seas he has seen in Cook Inlet were at least 15 feet. Skipper Gubert gets most concerned when the forecast is for strong southwest winds during significant out-going tides. It gets really interesting, he said. Wind and sea conditions during the trip were generally quite light. Winds reached about 15 kts in the afternoon with seas virtually nil in the open areas. Sea-ice conditions varied dramatically across the Inlet from a light sheen of slush on the water to pan ice nearly 4 feet thick. Skipper Gubert said ice conditions change quickly with any rapid changes in the air temperature. Air temperatures above 15 to 20 degrees soften the ice significantly. Drops in air temperature below zero harden the ice and form new ice very quickly. Tides, of course, affect ice movement.

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Coastal Forecast Office News

Atlantic Area

Miami, Florida NWSFO

Michael O'Brien

The National Weather Service Forecast Office at Miami composes a broad range of forecast products. Most familiar to the consumer is the public forecast covering most of Florida, and the severe weather watches and warnings, principally for south Florida. Aviation forecasts are an important part of the forecast suite but are not used by the general public. Marine forecasts form another major part of Miami's responsibilities and are vital to the general public—or at least to boaters and fishermen—and there are many thousands of such people in Florida.

Miami's marine forecast area is huge. There are two principal types of marine forecasts, the Offshore and the Coastal. The coastal area extends from Savannah, Georgia, south to Key West, Florida (facing the Atlantic), and then continues north facing the Gulf of Mexico to Appalachacola, Florida. This region measures about 1100 miles long and is 50 miles wide. The offshore area covers all of the Caribbean sea and the Atlantic ocean south of 32N and west of 65W. The offshore region is even larger than the coastal. At it's greatest extent from Miami to Trinidad it measures about 1600 miles.

Apart from tropical weather systems, the summer season is the more benign. In most years the Bermuda high sets up as a semi-permanent feature with consequent light winds across the southwest Atlantic and reduced trade winds over the Caribbean. Typically, about two months late in the summer define the most active part of the tropical storm season for Miami's area of responsibility. This is when often one or more storms or hurricanes may be traversing the region. Of course seas are extremely large near these storms, but the area encompassed by large seas and dangerously rough conditions is usually small compared to winter systems.

The winter season by contrast is marked by strong trade winds of 20 to 25 knots and the frequent intrusion of cold fronts. The fronts almost always cross the entire southwest Atlantic and often most, if not all, of the Caribbean. Commonly, a wave will develop on a cold front as it moves into the Florida coastal waters. If the front is moving relatively slowly a low pressure center will often develop from the wave and, perhaps due to the warmth of the gulf stream, quickly develop into a strong low pressure center.

This scenario is a frequent source of gales in Miami's forecast area. When these gales deepen further into a storm they usually do so north of 32N, which is outside of Miami's area. Still, large swells may be generated and move southward, affecting both the offshore and Atlantic coastal areas.

The winter time cold fronts and low pressure systems, although having weaker winds than tropical systems, have wind fields that cover vastly larger areas. An example would be the Caribbean, where trades of 20 to 25 knots blow for many days over the same thousands of miles of ocean, building seas that can reach 10 to 12 feet over hundreds of thousands of square miles, even though there is not a storm in sight.

The existence of the gulf stream along Florida's Atlantic coast is a very important factor in sea conditions in a zone that is heavily trafficked. Low pressure centers often form near the gulf stream and the prevailing wind, when flowing in a direction opposed the current of the gulf stream, can increase wave heights by one third or more and increase the steepness of the wave face. Larger waves, especially when they have steep faces, are much more dangerous to the small the waters than what might be

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Banda Seahorse Fam Float

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Russ felt there is a general misconception of how our customers view the ice forecasts. Russ and others working the NWSFO ice desk forecast total ice thickness. Their customers apparently think the forecasts are for ice that is visible.

CISPRI-contractor for the ship, John Whitney, NOAA Hazardous Materials Response Division in Anchorage, and Greg are working on plans to equip the vessel with wind sensors and a barometer. Oil industry money for oil spill prevention would fund the equipment. The vessel will hopefully become a reliable provider of marine weather observations year-round while operating in the Cook Inlet. The intent is to have the vessel join the VOS program.

Russ and Greg both agreed this was a most worthwhile trip. They encourage marine forecasters everywhere to consider taking familiarization floats whenever and wherever possible. Floats are valuable learning experiences.⚓

Coastal Forecast Office News

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expected if only wind speeds where taken into account.

The coastal and offshore forecast areas for which the Miami office has responsibility are both extensive and heavily trafficked. By utilizing ship and buoy reports and combining these with satellite and forecast model data it is possible to keep track of ongoing events and forecast conditions with good accuracy up to several days in advance. The coastal and offshore marine forecasts fill an essential role in planning and safety for thousands of boaters, whether recreational day sailors or the far traveling commercial fishermen.

Newport, North Carolina NWSO

Since December 1994, the National Weather Service Office in Newport, North Carolina (NWSO MHX) has been preparing the Coastal Waters Forecast out to 20 nautical miles including the Albemarle and Pamlico Sounds for the National Weather Service Office in Raleigh (NWSFO RAH). Meteorologists in Newport compose the forecast and a corresponding discussion of expected weather conditions and send them via computer to NWSFO RAH. Forecasters in Raleigh review the forecast and make any changes they deem necessary. The forecast is then disseminated to the public. This "shadow" forecasting for the Coastal Waters Forecast serves as a risk reduction exercise for meteorologists in Newport in preparation for Stage II of the National Weather Service modernization. When Stage II begins in late 1997 or early 1998, NWSO MHX will assume marine forecast responsibility for the North Carolina coastal waters out to 100 nautical miles.

In March of 1995, an agreement was reached between the North Carolina Ferry Division and the National Weather Service in Newport to start a Marine Reporting Network (MAREP) on the southern portion of the Pamlico Sound. Several weather reports are received daily from the Swan Quarter and Cedar Island to Ocracoke ferries midway on their routes. The weather reports consist of measurements of wind speed and direction, air temperature, wave height and significant weather (e.g. rain, snow, thunderstorms, fog, etc.). This information is used in the daily preparation of the marine forecast. In addition, the reports are broadcast over NOAA Weather Radio for use by area mariners and shared by computer with adjacent Weather Service Offices.

For the third consecutive year, we have maintained an information booth at the annual North Carolina Commercial Fishing Show in Morehead City. This has proven to be an excellent way for getting acquainted with commercial and recreational fishermen in the area. In return we have received valuable feedback on our products and services. We also have used this show to pass along information on how the modernization of the National Weather Service will improve forecasts and warnings for coastal North Carolina. People really enjoyed our displays on the WSR-88D which we have showcased each year. During last year's show, a questionnaire was distributed as apart of a larger NOAA Weather Radio survey we were conducting. Responses to this questionnaire led to several improvements in our NOAA Weather Radio broadcasts such as including the location of the western wall of the Gulf Stream and hourly reports from Diamond and Frying Pan Shoals.

Washington, DC NWSFO

Brian G. Smith

We at the Washington, DC, forecast office in Sterling, Virginia, produce two forecasts covering different marine areas and diverse product users: (1) the forecast for the Chesapeake Bay, the Tidal Potomac, and the Atlantic coast from Fenwick Island, Delaware, to Virginia Beach, Virginia, out 20 miles; and (2) the offshore forecast for the West Central North Atlantic from 32N to 40N, west of 65W, beyond 20 nautical miles from the coast. These forecasts are issued four times a day with updates as needed.

Whenever short-lived hazardous weather threatens either marine area, we issue the following: (1) Special Marine Warnings, for at most a three-hour period, to warn of thunderstorms or other phenomena that produce gale force winds not covered in the coastal and offshore forecasts; and (2) Marine Weather Statements, again for at most a three-hour period, usually to give details on weather already mentioned in the marine forecasts. In addition, over the Chesapeake Bay and coastal waters, warnings for tornadoes and severe thunderstorms (with large hail or winds at least 50 knots) will include adjacent waters as needed.

You can hear the coastal waters forecasts over NOAA Weather Radio. The offshore forecasts may also be found on NOAA Weather Radio and on the U.S. Coast Guard short-wave bands. Special marine warnings and marine weather statements are broadcast with a high priority on these same radio sources.

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Coastal Forecast Office News

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Mariners are invited to comment on the forecasts made by the Washington Forecast Office. Send your comments to: Washington Forecast Office, NOAA, National Weather Service, 44087 Weather Service Road, Sterling, VA 20166-9605, Attention Marine Focal Point.

Upton, New York NWSFO

Ingrid Amberger, Marine Program Leader

The National Weather Service Forecast Office Upton (NWSFO OKX) is located on the grounds of the Brookhaven National Laboratory (BNL) in Suffolk County, Long Island. The office was relocated to BNL in October of 1993 from Rockefeller Center in mid-town Manhattan due to the location of the new Doppler radar network. The office is still referred to as the New York City office.

NWSFO OKX forecast/warning area covers southeastern New York including the Lower Hudson Valley, New York City, and Long Island; northeast New Jersey, and the southern half of Connecticut. Our marine forecast/warning area covers the coastal waters from Watch Hill, Rhode Island, to Montauk Point, New York, to Sandy Hook, New Jersey, extending out 20 nautical miles from shore. The Long Island Sound and New York Harbor are also under OKX's forecast/warning responsibility.

NWSFO OKX has limited data sources for preparing marine forecasts. We have two data sources for our coastal waters which we receive on an hourly basis. One is a C-MAN, ALSN6 -Ambrose Tower, at the mouth of New York harbor, and the other is a moored buoy, 44025, located 20 nautical miles south of Fire Island Inlet. For Long Island Sound, we get data every three to six hours from the U.S. Coast Guard Stations at Eaton's Neck, New York and the Long Island Sound Group in New Haven, Connecticut. In addition, we also get data every three to six hours from Plum Islands, New York.

Due to the limited data sources, we encourage mariners to call NWSFO OKX to confirm that our forecast is on track or if you feel we need to update. NWSFO OKX can be reached by calling 1-800-226-0218. This number is for incoming marine reports only, other requests will not be granted.

NWSFO OKX has four weather radio transmitters.

(1) KWO-35 on 162.55 MHZ from Rockefeller Center in mid-town Manhattan. This transmitter services southeastern New York; including New York City, New York Harbor, the western half of Long Island, and Long Island Sound along with the adjacent coastal waters; northeastern New Jersey and extreme southwest Connecticut.

(2) WXM-80 on 162.475 MHZ from Riverhead in Suffolk County. This transmitter services the Suffolk County Long Island, most of Long Island Sound, and most of the adjacent coastal waters.

(3) WXJ-42 on 162.400 MHZ from West Peak in Meridan, Connecticut, located in northern New Haven County. This transmitter services the western three-quarters of Connecticut, Long Island Sound, and the north shore of Long Island.

(4) KHB-47 on 162.55 MHZ in Montville, Connecticut, located in southern New London County. This transmitter services the eastern half of Connecticut, the eastern portion of Long Island Sound, and southern Rhode Island.

On our weather radios, we broadcast public forecasts, coastal and offshore waters marine forecasts, hourly weather, local buoy reports, radar updates, short-term forecasts (three- to six-hour forecast), along with watches and warnings.

More information about NWSFO OKX forecast office can be found on our home page on the Internet, plus a wealth of weather data and forecasts. Our address is: http://ww.nwl.bnl.gov/~nws. We have hypertext links to products that are of primary interest to mariners. Observations and forecasts for the waters in the northwest Atlantic are included. We are in the process of preparing a marine section/page to our home page.

NWSFO OKX is conducting a mariner survey about our coastal marine forecast and weather radios. If you are interested in participating, please send a postcard with your address on it to: National Weather Service, 175 Brookhaven Avenue, Building NWS #1, Upton, NY 11973, Attention: Ingrid Amberger.

Along with the survey, you will receive a package of weather information tailored to the mariner. We appreciate feedback from our users.

Taunton, Massachusetts NWSFO

Tom Fair, Marine Program Manager

A rather significant winter event occurred on the afternoon of 19 January 1996. For two days, Numerical Weather Progs described the passage of a very strong cold

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Coastal Forecast Office News

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front with an elongated area of low pressure. The late afternoon surface map for the day of concern verified the progs with 10 to 15 degree temperatures in western Pennsylvania and 59 degrees in Boston. Ship reports from 35N all the way to the Maine coast repeated south winds near 40 knots. The buoy at 38.5N 70.7W had 25 foot seas and gusts to 43 knots. As this evolved, a tug pulling a barge named the "North Cape" was transiting south coastal Rhode Island. The tug experienced a major fire and was evacuated. The Coast Guard made both a dramatic helicopter rescue and an in-water swim to save the tugboat crew during the peak of 50-60 knot winds. The barge could not be secured and went up on Moonstone Beach on the southern Rhode Island coast. The barge leaked about 800,000 gallons of #2 fuel oil and made national headlines as the pollution came inside barrier beaches and dispersed south all the way to Block Island. The fuel oil caused both a fishing and lobstering ban for two to three months.

Gulf of Mexico Area

New Orleans/Baton Rouge, Louisiana NWSFO

Len Bucklin

The Gulf of Mexico supports approximately 200,000 persons that are directly involved with commercial and sport fishing. The Gulf commercial catch was worth $806.2 million dollars in 1994. This region supplies more commercial fish products than any other U.S. fishery except for the Alaska fishery. In addition, the Gulf of Mexico provides the largest finfish catch for sport fishers with an estimated annual value of $3.5 billion dollars.

The combined commercial tonnage shipped through the ports of New Orleans, Lake Charles, Gulfport, and Mobile equals or exceeds that shipped through all the East or West Coast ports. The port of New Orleans is one of the major ports of call for commercial vessels and rivals or exceeds the Houston and Miami ports in gross tonnage.

The New Orleans/Baton Rouge National Weather Service Forecast Office (NWSFO LIX) is located approximately 35 miles north of metropolitan New Orleans and 65 miles east of Baton Rouge, Louisiana. This office is responsible for monitoring and forecasting the weather conditions for the State of Louisiana and for the Gulf of Mexico. In particular, the staff at the New Orleans office produce the following products in support of the marine community:

(1) Coastal Marine Forecasts issued four times daily for the coastal waters from Apalachicola, Florida, to Port Arthur, Texas, and extends out to 50 nm from shore.

(2) Offshore Marine Forecasts issued four times daily which cover the remaining open waters of the Gulf of Mexico.

(3) Marine advisories and warnings are issued for conditions that may affect the safety of ships and crews and include: Small Craft Advisories, Gale Warnings, Storm Warnings, Coastal Flood Watches and Warnings. Tropical Storm and Hurricane Watches and Warnings are coordinated with the Tropical Prediction Center, formerly the National Hurricane Center.

(4) Special Marine Warnings are issued to cover significant convective activity that could affect the safety of ships and crews. This office issued special marine warnings for the coastal waters from Pascagoula, Mississippi, to the Atchafalaya Bay, Louisiana. This areal outline is based on the range of the NWS Doppler Radar. The remaining coastal waters are covered by additional NWS Doppler weather radars located at additional NWS offices in Texas, Alabama, and Florida. The New Orleans office also issues Special Marine Warnings for the offshore waters based on the analysis of ship and satellite data.

Forecast parameters differ between the Coastal Marine and Offshore Marine forecasts. More specific values for wind velocities and sea heights are forecast in the Coastal Marine Forecast than in the Offshore Marine Forecast. This is based on the assumption that smaller recreational vessel traffic is restricted to within 50 nm of shore. Each product contains a 36-hour forecast of the prevailing wind direction and speed, forecast sea heights based on average of the highest one third of sea heights expected, major synoptic features affecting the Gulf of Mexico, significant weather that will affect visibility or pose a threat to the vessels, and a general outlook to five days.

New Orleans has a Port Meteorological Officer, John Warrelmann, assigned. His territory covers the commercial ports from Mobile, Alabama, to Lake Charles, Louisiana. As the PMO, he is tasked to provide assistance to commercial vessels in port and to encourage additional vessels to join the Voluntary Observation Ship program.

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Another factor which makes the New Orleans office unique is that this office is co-located with the Lower Mississippi River Forecast Center. The River Forecast Center monitors and forecasts the flow rate and changes in heights of the Mississippi River from southern Illinois to the Gulf. This includes the discharge of major and minor tributaries that drain into the Mississippi river basin.

Great Lakes Area

Cleveland, Ohio NWSFO

Daron Boyce, Senior Marine Forecaster

The Great Lakes Navigation Season for 1996 got off to a cold and slow start in March.

A consistently colder than normal winter, combined with abundant amounts of snow across the region, resulted in significantly larger amounts of ice cover over the Lakes. Lake Erie and nearby Lake St. Clair were mostly ice covered and large portions of Lakes Superior, Michigan, and Huron also had ice cover as the season opened during mid-March. The locks at Sault Ste. Marie, Michigan, opened on March 28th.

The U.S. Coast Guard icebreaker Mackinaw convoyed commercial vessels across Lake Superior and the Coast Guards fleet of "bay-class" ships assisted the vessels in numerous other areas of the Great Lakes system.

Ice up to three feet deep was still observed during the middle of May on the upper St. Mary's River above the Sault and ice was still reported along most of the southern Lake Superior shoreline off Duluth to Whitefish Bay. Several commercial vessel companies were assessing damages to their vessels during the unusually tough opening.

Pacific Area

Anchorage, Alaska WSFO

David Percy

The marine area of responsibility for the Anchorage Forecast Office is large (see figure below). It includes the offshore areas of the Gulf of Alaska and Bering Sea, as well as the coastal areas extending west from Cape

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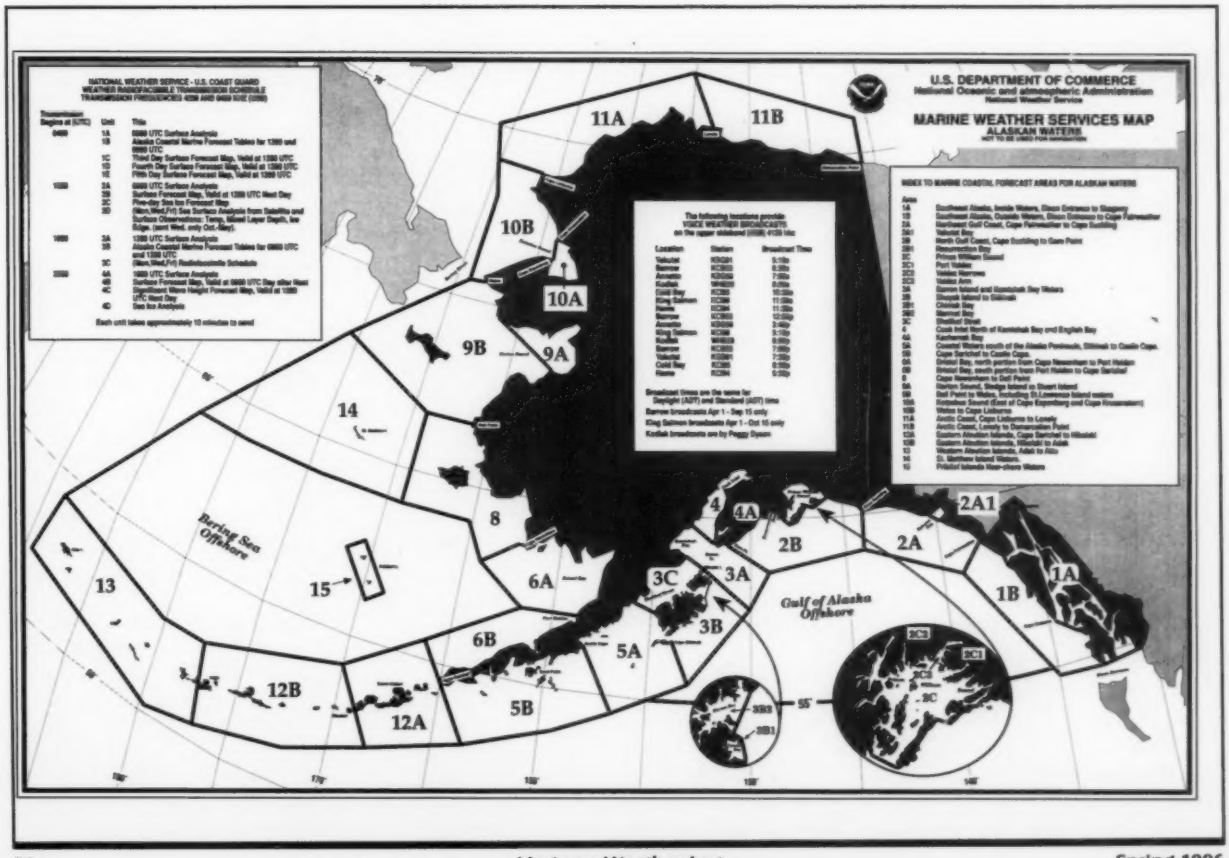

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Suckling (area 2B) westward to Attu Island at the end of the Aleutian Chain (area 13). Coastal forecast areas also extend northward along the southwest Alaskan coast from Dall Point (area 8). During the winter months it is not uncommon for three major storm systems with gale- or storm-force winds, along with heavy icing conditions, to affect the Anchorage forecast area at one time.

The topography of much of the land adjacent to the coastal areas is mountainous, which makes forecasting winds and sea heights quite a challenge. One of the best examples of channeled winds is seen through Kamishak Gap during an arctic outbreak. Northwest winds through area 3A can reach sustained speeds over 80 knots for several days, while just to the north over Cook Inlet (area 4), wind speeds may only be 30 knots.

The 1995-96 season was mild across the Bering Sea and Aleutians. Sea ice failed to reach the Pribilof Islands for the first time since 1989. The severe cold that persisted over interior Alaska and the Yukon from mid-November into February resulted in a mild southerly wind across the Bering Sea during this same period.

Juneau, Alaska WSFO

Leif Lie

The Alaska coast provides the mariner with some of the most magnificent scenes and fruitful fishing in the world. Through most of the summer, day after day often pass with light breezes and pleasant weather. But as in any marine environment, weather must always be monitored.

Gale- and storm-force winds occur throughout the year in Alaska, but they are least likely from mid-May through mid-August. Local modification of winds by terrain, differential heating and gravity occur more often and farther out to sea than in most parts of the world. Mountains and glaciers that frequently extend very close to tidewater combine with strong pressure gradients to produce funneling of the wind well out to sea. Long summer days and cold ocean waters create sea and land breezes that would be considered unusually strong in many other parts of the world.

Structural icing or freezing spray and temperatures below 32°F, while not absolutely unique to Alaska, are outside of the experience of most mariners. These elements are included in Alaska Coastal forecasts when they are occurring or expected to occur. Sea ice analysis and forecasts are issued throughout the year.

The Juneau marine area includes the Dixon Entrance to Skagway (area 1A). In the winter, strong outflow from the Yukon and British Columbia will create gale- and storm-force northerly winds in the inner channels when conditions are favorable.

The outside waters (areas 1A and 2A) include the Dixon Entrance to Cape Fairweather and Cape Fairweather to Cape Suckling. These outside waters consist of the eastern Gulf of Alaska. During the fall and winter months, storm-force wind episodes frequently affect the area.

San Francisco, California NWSFO

Duane Dykema, Forecaster
San Francisco Bay Area, Monterey, California
and
Tom Ainsworth, Regional Marine Focal Point, NWS Western Region Headquarters
Salt Lake City, Utah

Marine Weather Forecasting In The Modernized National Weather Service

The National Weather Service (NWS) is in the midst of a major program of modernization and restructuring. Modernization efforts are based on new technologies and expanding knowledge in the sciences of meteorology and hydrology. Advances in weather radar, weather satellites, sophisticated information processing and communications systems, superspeed computers, and automated weather observing systems are the foundation for the modernization effort. Warning and forecast areas of responsibility are being restructured so forecasters can apply the scientific and technological advances with greater precision over smaller areas. With the introduction of these new technologies, NWS forecasters will receive intensive training to appropriately apply these advancements to marine weather forecasting. As a result of the modernization and restructuring, marine warning and forecast services will be improved.

One of the new technologies associated with NWS modernization currently being deployed around the country is the next generation doppler weather radar, or WSR-88D. These new radars, capable of detecting both reflectivity and velocity of targets (for example, rain drops), are already providing forecasters with more precise information on the development of precipitation, winds, squall lines, and even tornadoes. Coastal radar sites are providing a more detailed three dimensional

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weather picture over Coastal and Great Lakes waters than was available with previously used radars, some of which were almost 40 years old.

An evaluation of WSR-88D applications in the marine environment will take place at six NWS coastal Forecast Offices (Boston, Houston, Monterey, Chicago, Anchorage, and Honolulu). The objective of this intensive evaluation will be to determine how the capabilities of the WSR-88D can be used to enhance the content, timeliness and accuracy of marine warnings and forecasts. As part of the evaluation, collaborative research activities between NWS offices and universities and research facilities will be established. Also, Marine Customer Evaluation Committees, made up of customers of NWS marine warnings and forecasts, will be created. These evaluation committees will help determine the needs of the user community, assure that NWS marine weather products are relevant to the user, and be used to increase awareness of the NWS Marine Reports (MAREPS) program.

Since the early 1960s, data from weather satellites have had a major impact on weather forecasting. Because the surface observing system over water is less dense than over land, satellite data is vitally important for marine weather forecasting. Recently, two new Geostationary Operational Environmental Satellites (GOES) were launched into service. From their positions over the western Atlantic and eastern Pacific, they provide a broad view of North America, as well as the Pacific and Atlantic breeding grounds for winter storms and hurricanes. These new satellites provide more detailed and refined images of atmospheric moisture and temperature distribution than older satellites did. They also provide more frequent images than prior geostationary satellites, up to one image per minute in super rapid scan, which will be particularly useful during severe weather. The new satellites are equipped with advanced imagers and sounders to create three-dimensional profiles of atmospheric conditions. These instruments will lead to improved weather analysis, including better night time fog detection and better surface wind speed estimates. The streams of data transmitted from the satellites will be fed into the computer forecast models, resulting in better model initialization and, ultimately, better model performance.

Over the years, advances in computer technology have led to improved forecast skill. With the advent of faster and more powerful computers, forecasting can be done with higher resolution on a smaller scale, allowing for more detailed analysis and prediction of atmospheric and sea state variables such as wind, precipitation, and ocean waves. The computer models being developed today have a much finer resolution than those of a few years ago and are capable of representing the coastal geometry, topography, and boundary layer physics to produce reliable forecasts. These models are known as mesoscale or regional models. Several mesoscale models are already supplying forecast variables to NWS field offices. Some of these models include the National Weather Service's Meso Eta and Rapid Update Cycle (RUC) models and the Navy's Navy Operational Regional Atmospheric Prediction System (NORAPS) model. Along with atmospheric models, the latest ocean wave generation model, called WAM, is being used by both the NWS and Navy. Future enhancements to the WAM model will allow it to be integrated into the Navy's Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) to provide very high resolution two-way interactive wind/wave products for coastal regions.

Studies are already underway to determine the skill of these computer forecast models. For example, at NWS Forecast Office San Francisco Bay Area in Monterey, studies already completed include investigating the Meso Eta's skill at predicting two significant marine weather phenomenon: the Catalina Eddy off the southern California Coast and the onset of southerly stratus surges up the Central California Coast.

Even with the technological advancements and forecaster training, we must not lose sight of the importance of current marine weather observing systems. Weather data received from both moored buoy platforms and drifting buoys, as well as the Voluntary Observing Ship program, will continue to provide much needed atmospheric and sea state information to forecasters and mariners alike. These observations are not only important for short-term forecasting, but also provide a source of forecast verification.

A key element of the NWS modernization is the proliferation of automated surface observing systems across the U.S. These observing platforms provide weather observations 24 hours a day from locations that previously had only part-time observers (or no observers at all). The NWS continues to examine ways to extend a similar automated observing

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network seaward. Concerns about efficiently maintaining and repairing an automated weather observing network in the harsh marine environment, however, are proving to be significant challenges to making such a network a reality.

Because of improved analysis and forecast technologies, the NWS is currently restructuring existing forecast area boundaries. Once all of the WSR-88D radars along a contiguous seaboard become operational, the coastal forecast areas will be subdivided into smaller areas. These areas will be based on similar prevailing weather conditions or prevailing user activity within the forecast area. Meanwhile, the number of NWS Forecast Offices issuing coastal warnings and forecasts for the coastal ocean waters and the Great Lakes will increase from 19 to 32. The larger number of forecast offices issuing marine weather warnings and forecasts for smaller marine coastal forecast zones will allow for more precise forecasts. An education campaign will be conducted by the NWS well in advance of implementing the restructured forecast areas to familiarize mariners with the changes.

To assist modernized coastal forecast offices in concentrating on local marine weather hazards, responsibility for marine weather services in the "offshore waters" (greater than approximately 100 nautical miles offshore) will be shifted to National Centers for Environmental Prediction (NCEP). The Marine Prediction Center (MPC) in Washington, DC, will forecast for oceanic offshore waters and high seas waters north of 30°N. The Tropical Prediction Center (TPC) in Miami, Florida, will forecast for the offshore waters in the Gulf of Mexico and Caribbean Sea, and tropical high seas waters of the Atlantic and Pacific south of 30°N. To ensure that MPC and TPC have the capability and resources to take over offshore marine weather services from the field, a risk reduction exercise has been developed to study what steps are necessary to transfer the offshore forecasts from field offices to NCEP. A risk reduction plan currently being carried out involves MPC and forecast offices in Monterey and Seattle.

Implementation of the reconfigured coastal zones and transfer of offshore forecast responsibility will be phased in during the next couple of years. The timing of the various phases will depend on the outcome of Marine Evaluation Plans, customer outreach, and the risk reduction plans currently being carried out.

As the agency's modernization and restructuring goes forward, the NWS will keep the marine community fully aware of changes in marine weather services before they occur and while they are being implemented. The feedback received from our customers in the marine community during this process will be one of the most important ingredients used to improve marine warnings and forecasts in the modernized NWS.

Oakland, California NWSFO

Bob Novak, PMO

The Need For Weather Observations

The National Weather Service is nearing the end of their Modernization and Associated Restructuring. Part of this modernization has been the installation of radars along the Pacific Coast.

Each radar has not only storm detecting capability, but also has the ability to give us wind direction and speed out to 125 nautical miles offshore. These radars are the first of their kind along the West Coast. We have already seen more detail in the approaching weather systems over the past two winters with these radars. Each weather office with radar capability has new and challenging information.

Over the next few years, ground/sea truth information will be important to help us scientifically evaluate what we are seeing. Ground/sea truth will be provided on land by automatic gauges and other surface observations. Over the ocean, our data will be provided by buoys and ships. Currently the density of buoy information and ship reports is not enough to provide us with a good scientific data base for study.

Additional ship reports, especially during periods of stormy weather, will help augment our data sources. If ships traversing the Pacific Coast would take two or more synoptic observations and transmit them, this would help augment the data base.

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Here is just one example of how important off-shore synoptic observations can be. Observations from sea 11-12 December 1995, showed an eastern Pacific storm was much deeper (pressure readings lower) than forecast models predicted. Pressure tendencies were still lowering. Using the offshore surface data, forecasters were able to provide 18 to 24 hours advance warning to coastal residents and marine interests that wind gusts would exceed 100 mph and seas near shore would reach 30 feet high. The same data were used for weather warnings inland that pertained to public and aviation safety.

Honolulu, Hawaii WSFO

Hans E. Rosendal, WFO

As the location of the Hawaiian Islands in the middle of the Pacific Ocean may suggest, the marine program with its service to the marine community has always been considered of prime importance at the National Weather Service Forecast Office in Honolulu.

The Forecast Office's meteorologists monitor the weather across the entire Pacific and issue high seas forecasts for a large portion of the ocean between 30N and 25S latitudes bounded by 140W and 160E longitudes. In addition, a coastal marine forecast is issued for the Hawaiian waters and the channels between the islands. The forecasts are issued every six hours. Radio fax charts are also prepared and transmitted from Honolulu.

Whenever tropical cyclones of the eastern North Pacific move into or form within the area between 140W and the International Dateline, the forecast office takes on the added responsibility of issuing advisories under the auspices of the Central Pacific Hurricane Center. A number of tropical storms and hurricanes pass by the Hawaiian Islands but rarely are the Islands struck severely. Hurricane Iniki in September 1992 and ten years earlier, hurricane Iwa in November 1982, both did severe damage to Kauai, the westernmost of the main Hawaiian Islands.

Part of the marine forecast program consists of surf forecasting for the Hawaiian beaches. Surf is not only a recreational or tourist attraction, on occasion it becomes outright dangerous and life threatening when surf as high as 30 feet pounds the exposed shores and may damage shoreline property. A number of lives are lost each year to surf as swimmers, surfers, and beachgoers get careless near the high surf. The northwest and north shores are hit the hardest between November and March, while the south shores receive surf from southern hemisphere storms from May through September. The large swell also causes the harbor surges and may disrupt or cause problems for the recreational boater at his anchorage.

The marine observations play a very important part in the surf forecasting program at the Honolulu National Weather Service Office. Surface weather charts are plotted and analyzed four times a day and the wave/swell groups are closely scrutinized. As a general comment, it can be mentioned that swell wave height and direction are observed very well, while the more difficult wave period quite often is reported too short. Swell waves that end up as 20 second surf on the Hawaiian beaches probably are predominantly 15 second waves when they leave the generating areas 2,500 miles away three or four days earlier. It is difficult on a moving ship, often in darkness and with locally produced seas mixed in, to get a good estimate of period. Data from the NOAA buoys anchored in deep water 300 miles or so from Hawaii enable us to sort out the spectrum of values of periods and heights. The buoy data thus is useful in giving the forecaster a 10-hour or so "heads up" while the ship observations are needed for the longer lead times.

As we are sure the mariner is aware, the forecasts have improved immensely over the years thanks in no small measure to global coverage and observational data from satellites, ships, and aircraft, data which in turn are used in producing the computer forecasts solving the physical states and motions of the atmosphere as much as a week into the future. There is, however, still much room for improvement in forecasting and in delivering the forecasts in a useful fashion to the end user, namely the mariner. We will strive to do our best at this end.⚓

Mount Desert Rock Lighthouse

Elinor De Wire

"What mad misanthrope chose to build a lighthouse on this hostile, forsaken rock?" asked a 19th century writer. Storm waves often breach Mount Desert Rock, the wind scours it mercilessly, and on many occasions huge rocks—some weighing as much as 75 tons—have been tossed onto its craggy plateau. Sequestered and exposed the full fury of the Atlantic, it is among the nation's loneliest outposts.

On this barren, half-acre shelf of granite 24 miles out in the Gulf of Maine stands Mount Desert Rock Lighthouse. The 58-foot, rough-hewn tower appears to grow out of the jagged ledge, as if carved by the waves. But human hands built this sentinel at great risk, for the sea here seems never still and safe anchorage for a boat is nearly impossible.

A lighthouse was first placed here in 1929, a ramshackle affair consisting of a small wooden house with a beacon on its roof. The lightkeeper and his family led a wretched and isolated existence, plagued by the weather, hunger, and separation from civilization. To assuage their misery, fishermen brought them barrels of soil and flower seeds, which they crammed into the crevices of ledge to make rock gardens.

In 1893, the current stone tower was built. Its rotund, sloping form, gray and sturdy, was designed to direct waves back upon themselves and to discourage the wind from lingering. Despite its age, the tower remains strong and still serves the fishermen and boaters of Blue Hill Bay and Frenchman's Bay.

Mount Desert was among the most challenging assignments for lightkeepers, even after the Coast Guard took over in the 1940s and such amenities as a television and video games broke the monotony and solitude. Under Coast Guard management, Mount Desert was a "stag station," with only men serving, but early in its career, families lived at the secluded beacon. A year's supply of provisions was kept in the storerooms, in the event the supply tender could not make regular visits. Children were tethered to prevent falls from the 20-foot cliffs surrounding the rock, and wives seldom got off the rock. One woman who lived at the lighthouse at the turn-of-the-century did not visit the mainland for seven years.

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Mt. Desert Rock Light, circa 1890s. The family of one of the keepers is standing beneath the fogbell. Note the storm doors on the windows!

Lighthouse

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Winters were especially difficult. Wild Atlantic storms raged over the rock, imprisoning the lightkeepers for days at a time. When they had to clean the exterior of the lighthouse lantern, leather harnesses were used to prevent falls. The rock was bitterly cold and ice build-up in the lantern and house was a problem. No wood was available on the rock, so the families had to ration coal and kerosene carefully for the stoves.

Numerous wrecks have occurred near the lighthouse, including the ocean tug Astral, which crashed into the submerged north end of the ledge at Mount Desert in a December 1902 gale. The lightkeepers heard the Astral's whistle screaming through the flying vapor and went to the tug's assistance. Despite frigid temperatures and a hampering high tide, they were able to rescue all but one of the crew of eighteen using ropes and life preservers.

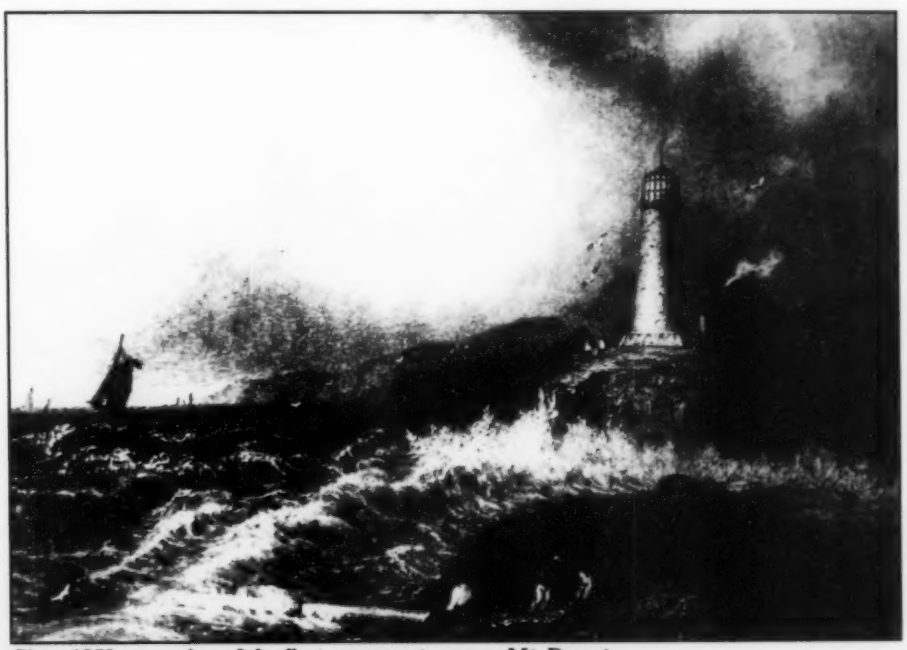
Mount Desert Rock Lighthouse withstands some of New England's heaviest weather. The gale of 1842 dislodged a 57-ton boulder from the tideline of the ledge and tossed it on the rock's plateau. Another storm moved a 75-ton rock a distance of 60 feet. The station's earliest fog signal was a large bell rung by hand. The bell keepers were relieved when a steam foghorn was installed in the 1890s. Its harsh wail was more audible than the lilting tones of the old fogbell, and its coal-fired bellows operated the signal automatically.

Mount Desert Light was completely automated in 1977 and its last two Coast Guard keepers were removed. Both were happy to leave the lonely station, but they were quickly replaced by other attendants. Today the College of the Atlantic in Bar Harbor, Maine, utilizes the station for marine studies.

Students live on the rock for varying periods and keep watch from the lighthouse lantern for whales and other marine life. They also conduct bird banding of the tiny pelagic Leach's storm petrel which seeks refuge on the rock but does not nest there because there is no soil in which to burrow.

Information is collected on the types of whales sighted and their behavior patterns. Large baleen whales and small-toothed whales frequent these waters and vary in population according to the availability of herring and plankton. Because of Mount Desert Rock's remote offshore location amid colliding currents, its waters are rich in marine life and whale behavior is undisturbed by boat traffic.

The lightkeepers of yesterday considered Mount Desert Rock a dreadful assignment, but for the 40-some volunteer researchers who come to the rock each year, it's one the world's finest living laboratories and a beacon of light for marine science.⚓



Circa 1859 engraving of the first masonry tower on Mt. Desert.

South Street Seaport Museum

New York, NY

Norman Brouwer, Curator of Ships

During the sailing ship era the natural channels of New York Harbor were usually adequate for the vessels that used them. The one major exception was Hell Gate, the twisting narrows of the East River between Astoria, Long Island and the southern tip of the Bronx. The waters of Hell Gate contained numerous hidden rocks and reefs and powerful currents on which ships, totally dependent on the vagaries of the wind, could easily founder. The British frigate Hussar was sunk in this way during the Revolution, allegedly carrying payroll for the British Army. Attempts to blast some of these obstructions out of Hell Gate prior to the Civil War met with little success. In 1867 Lt. Col. John Newton of the Corps of Engineers was given the job. Newton saw that placing explosives on top of the reefs was having little effect due to the hardness of the stone. He designed a barge on which he mounted a number of powerful drills. Newton's crew inserted explosives into deep holes created by the drills. A portion of the reef would then be blown into fragments that could be removed by a clamshell dredge. When dredging was being done at one site, Newton employed his drilling barge at other jobs in the harbor, including the removal of Diamond Reef off the lower end of South Street near Coenties Slip. The sturdiness of Newton's barge was demonstrated by the large number of collisions it endured. In one 24-hour period lying in Hell Gate it was hit three times by tugboats or the barges they were towing. Drilling and blasting eliminated the smaller obstructions in Hell Gate, but removing the two largest reefs in the East River required major feats of engineering. At Hallett's Reef off Astoria, Newton had his workmen dig a 33-foot deep pit in the rock. A series of tunnels 10 feet wide and 20 feet high extended outward from the pit, honeycombing the reef. The excavation work was completed in the summer of 1876. The tunnels were filled with explosives and flooded, and on September 24 the reef was reduced to submerged rubble in a massive underwater blast detonated by electric current. It took another six years for dredges to remove the broken up rock. The other reef was Flood Rock, located in the center of the river north of Blackwell's (now Roosevelt) Island. Some work was begun there in 1875, but because of temporary cuts in appropriations, it did not get underway in earnest until 1879. Newton, now a brigadier general, used much the same techniques as at Hallett's Reef, filling four miles of tunnels with explosives. On October 10, 1885, an estimated 50,000 spectators watched the blast, believed to be six times greater than any previous man-made explosion. Water rose some 250 feet in the air. To demonstrate mankind's harnessing of this tremendous force, the electric current that set off the powerful blast was triggered by a twelve-year-old girl pressing the key. In 1874 the State of New York asked the federal government to investigate ways to turn the winding and shallow Harlem River into a useful waterway for shipping. Between 1875 and 1881 Colonel Newton prepared three proposals for this work. The project finally got underway in January 1888. The most difficult part of the operation was digging a canal through the northern tip of Manhattan just below 225th Street, in an area known as Dyckman's Meadows. In 1890 a reporter for the New York Sun wrote, "Walking in toward the cut the visitor suddenly finds himself facing a gap in the hill 350 feet wide. Rocky walls rise on either side perpendicularly to a height of over a hundred feet, their outlines fringed with great trees." The improved waterway was officially opened in 1895; traffic on the Harlem River increased dramatically. It did not become the shortcut between the Hudson River and Long Island Sound that some had envisioned, but it did become an important part of the port's lighterage system, as freight terminals and industries supplied by water sprang up on its Bronx shoreline. In 1906 the North Side Board of Trade requested federal funds to further improve the waterway by eliminating a sharp bend near its western end. This was not undertaken until the 1920s, when another cut was made, this time through a portion of the Bronx. At the same time, four brick piers of the High Bridge on the Croton Aqueduct were removed and replaced by one large steel arch, to allow easier passage for ships.

The South Street Seaport Museum, devoted to interpreting the history of New York as a port city, is located in the 11-square block historic district along New York City's South Street. Once known as the "Street of Ships," South Street and the surrounding neighborhood was the city's main port in the 19th century. Today it is home to the museum's fleet of historic vessels, including two 19th-century fishing schooners, the lightship Ambrose, and two large sailing cargo vessels—the Peking and Wavertree.⚓

The Mariners' Museum Research Library and Archives: A Resource for Information on Ocean Liners to Runabouts

Benjamin H. Trask, Librarian

It would be difficult to imagine a logical connection between nineteenth-century ship logbooks and the current global warming trends. But Professor of Meteorology Reginald E. Newell of the Massachusetts Institute of Technology has conducted research using old logbooks that may give insight into warming cycles. Nineteenth-century shipmasters measured water temperatures in search of major currents that could aid navigation. Captains and mates recorded these sea temperatures and their locations in official logs. Newell has studied the techniques and equipment used by mariners to record these temperatures and has extracted these entries in an attempt to compare the data with similar data gathered by present-day scientists. He hopes to determine the extent of warming not of the atmosphere but of the earth's oceans, which cover 71 percent of the planet's surface. Part of his research with the logbooks was undertaken at The Mariners' Museum Research Library and Archives in Newport News, Virginia.

Archer Milton and Anna Hyatt Huntington founded the museum and library in 1930. This in itself was unusual, as the library was a integral part of the institution from its conception, not an offshoot that sprouted years after the museum's creation. Through sixty-six years of intensive

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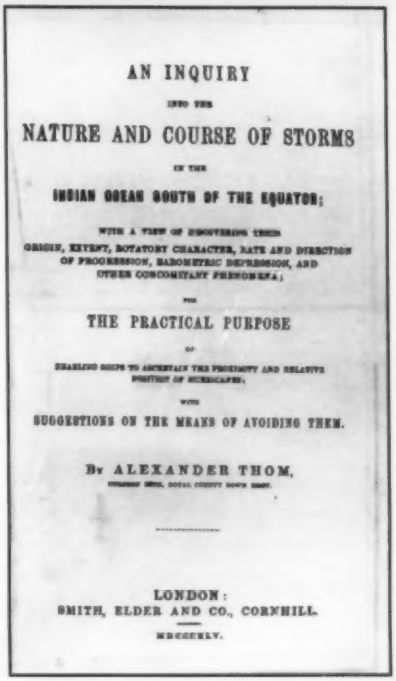


AN INQUIRY

INTO THE

NATURE AND COURSE OF STORMS

IN THE

INDIAN OCEAN SOUTH OF THE EQUATOR;

WITH A VIEW OF DISCOVERING THEIR

ORIGIN, EXTENT, ROTATORY CHARACTER, RATE AND DIRECTION OF PROGRESSION, BAROMETRIC DEPRESSION, AND OTHER CONCOMITANT PHENOMENA;

AND

THE PRACTICAL PURPOSE

OF

ENABLING SHIPS TO ASCERTAIN THE PROXIMITY AND RELATIVE POSITION OF HURRICANES;

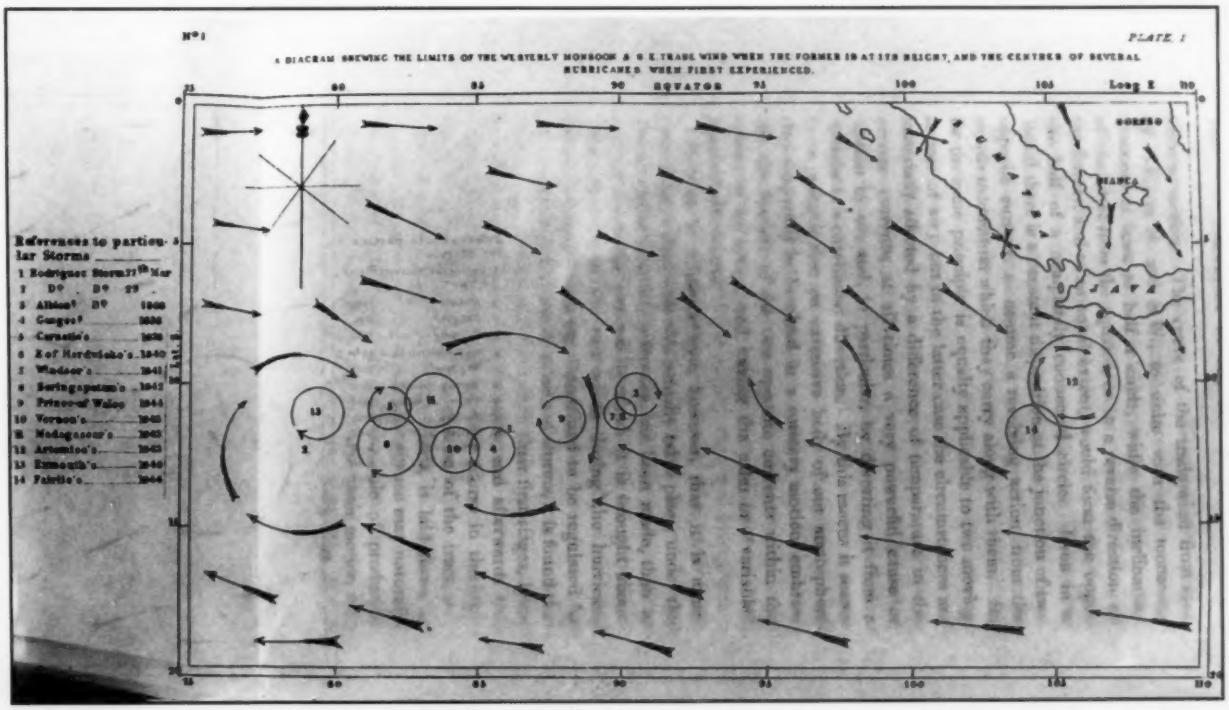
AND

SUGGESTIONS ON THE MEANS OF AVOIDING THEM.

By ALEXANDER THOM,

LONDON:
SMITH, ELDER AND CO., CORNHILL.

The title page from one of the 5,000 rare books in The Mariners' Museum Research Library and Archives.



A plate describing the monsoons and trade winds off the coast of present-day Indonesia from Alexander Thom's An Inquiry Into The Nature And Course of Storms...(London, 1845).

Mariners' Museum

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collection development, the librarians and archivists have amassed more than 75,000 volumes, 500,000 photographs, 50,000 ship and boat plans, 800 logbooks and diaries, and one million holographic manuscript items and printed pieces of ephemera.

The ephemeral holdings include 20,000 postcards, ocean liner menus, packet schedules, and postal cachets. The library also subscribes to 175 magazines, newsletters, and journals from twelve countries. Currently, the library accessions more than 1,000 volumes a year into the collection. Among the volumes is an outstanding concentration of rare maritime books. Dating from the early 1500s, these 5,000 volumes consist of coastal pilot guides, colorful travel accounts, explorers' memoirs, government reports, atlases, shipbuilding manuals, and astrological tables.

The staff assists patrons seeking information on lighthouses, scrimshaw, navigational instruments, marine painters, and shipwrecks. The museum's educators and curators also use the library constantly as they prepare lesson plans and exhibitions. The most frequently asked questions concern vessel histories.

To meet this challenge, the library houses the best collection of ship, yacht, and boat registers in North America. This includes an almost complete set of American and British ship and yacht registers; similar volumes for American and Canadian Great Lakes vessels; broken runs of German, Italian, French, Norwegian, and Japanese ship registers; and works describing warships of the world.

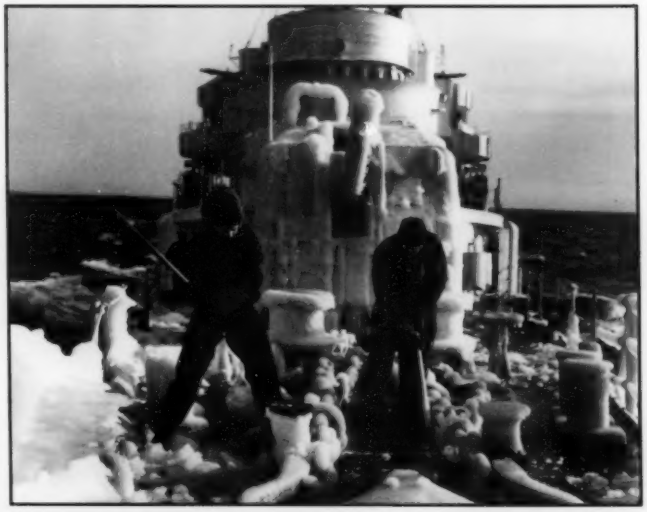
A passion among many hobbyists is the restoration of older wooden boats to their original specifications. Upon completion of their restoration projects, many owners display their handiwork and compete at established antique boat shows in California, Michigan, Florida, and New York.

Today, the older mahogany classics are highly prized, while the later fiberglass boats are still sought by many. Last year the archives accepted its final shipment of records from Chris-Craft Industries. The collection now covers all models produced from 1922 to 1980, and includes records on individual hulls, plans, photographs, sales and promotional catalogs, manuals, and engine master records. This is by far the most heavily used collection in the archives. The archivist and his staff assist about 1,100 Chris-Craft buffs a year. The interest in this hobby is so great that the museum cosponsors a biennial symposium, and is adding documentation from other recreational boat companies to the archives.

Those interested in knowing more about the facility may request the brochures on the Museum, library and archives, the Chris-Craft Collection, or the USS Monitor Collection. Research requests made in writing are welcome and must be the accompanied by the basic research fee of $10.00; extensive research can be arranged through the librarian. Last year the staff answered at least one letter from every state in the union and from twenty foreign countries.

The library is open to the public free of charge from 9:00 A.M. to 5:00 P.M., Monday through Saturday. It is closed on holidays. The museum has its own photography staff capable of reproducing transparencies and prints suitable for high-quality publications.

Each year the staff helps historians, researchers from the motion picture industry, artists, lawyers, educators, novelists, recreational divers, students of all academic levels, veterans, genealogists, and journalists in their quests for maritime information. We look forward to assisting all individuals with a nautical interest with their own research needs.⚓



While off the coast of Labrador, two crew members of the USCG Umimak (seaplane tender) employ ax handles and baseball bats to remove the ice from the deck of their vessel.

VOS Cooperative Ship Reports

The tables for the VOS reports are compiled by the National Climatic Data Center from radio messages and weather logs. Forms are counted in the monthly totals for each ship when it is received at the NCDC; normally within 60 days from the end of a data month. The three columns under manuscript heading "RECEIVED" denote if a form was received for that month or not. Data received late are not counted, but are still entered into the data base.

Some ships may show 100% radio observations, but show forms were also received. This occurs when the mail and radio observations are duplicated.

Only the radio message was entered into the data base.

The names of ships listed are from the list of vessels supplied by the Port Meteorological Officers(PMOs) to the NCDC. Comments or questions regarding this report should be directed to NCDC, Operations Support Division, 151 Patton Ave, Asheville, NC 28801 attn: Dimitri Chappas (phone: 704-271-4437 or e-mail: dchappas@ncdc.noaa.gov).

July-September 1995

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
1ST LT ALEX BONNYMAN	19	100.0	N	N	N
1ST LT BALDOMERO LOPEZ	39	89.7	Y	Y	Y
1ST LT JACK LUMMUS	8	50.0	Y	N	N
2ND LT. JOHN P. BOBO	9	66.6	N	N	N
A. V. KASTNER	2	100.0	N	N	N
ACACIA	29	89.6	Y	Y	N
ACADIA FOREST	187	38.5	Y	Y	Y
ACT 7	224	100.0	N	N	N
ACT I	145	100.0	N	N	N
ADABELLE LYKES	150	40.6	Y	Y	Y
ADAM E. CORNELIUS	99	66.6	Y	Y	Y
ADVANTAGE	112	66.9	Y	Y	Y
AGULHAS	153	88.2	Y	Y	Y
AL AWDAH	57	100.0	N	N	N
AL SAMIDOON	77	100.0	N	N	N
AL SHUHADAA	140	100.0	N	N	N
AL TAHREER	243	100.0	N	N	N
ALASKA	48	0.0	N	N	N
ALBEMARLE ISLAND	35	85.7	Y	Y	Y
ALBERNI DAWN	197	100.0	N	N	N
ALDEN W. CLAUSEN	195	79.4	Y	Y	Y
ALGENIB	229	100.0	N	N	N
ALLIGATIOR WISDOM	60	100.0	N	N	N
ALLIGATOR AMERICA	30	100.0	N	N	N
ALLIGATOR BRAVERY	93	83.8	Y	Y	Y
ALLIGATOR COLUMBUS	93	48.3	Y	Y	Y
ALLIGATOR EXCELLENCE	203	99.5	Y	Y	Y
ALLIGATOR FORTUNE	159	100.0	N	N	N
ALLIGATOR GLORY	73	100.0	N	N	N
ALLIGATOR HOPE	94	92.5	Y	Y	Y
ALLIGATOR JOY	153	84.9	Y	Y	Y
ALLIGATOR LIBERTY	66	100.0	N	N	N
ALLIGATOR STRENGTH	144	62.5	Y	Y	Y
ALLIGATOR TRIUMPH	26	0.0	Y	Y	N
ALMANIA	22	100.0	N	N	N
ALPENA	72	95.8	Y	N	N
ALPHA HELIX	45	73.3	N	N	N
ALTAMONTE	38	97.3	Y	Y	Y
AMALIA	59	86.4	Y	Y	Y
AMAZON	22	95.4	N	N	N
AMBASSADOR	27	70.3	N	N	N
AMERICA STAR	182	100.0	N	N	N
AMERICAN CONDOR	236	26.2	Y	Y	Y
AMERICAN CORMORANT	59	100.0	N	N	N
AMERICAN FALCON	79	91.1	Y	Y	Y
AMERICANA	34	26.4	Y	Y	Y
AMERIGO VESPUCCI	76	31.5	Y	Y	Y
ANASTASIA	7	100.0	N	N	N
ANATOLIY KOLESNICHENKO	49	100.0	N	N	N
ANDERS MAERSK	38	60.5	N	N	N
ANNA	18	100.0	N	N	N
ANNA MAERSK	32	81.2	Y	N	N
ARABIAN SENATOR	99	100.0	N	N	N
ARCO ALASKA	36	0.0	Y	Y	Y
ARCO ANCHORAGE	20	25.0	Y	Y	N
ARCO CALIFORNIA	59	67.7	Y	N	N
ARCO FAIRBANKS	7	0.0	Y	N	N
ARCO INDEPENDENCE	23	39.1	Y	N	N
ARCO JUNEAU	8	100.0	N	N	N
ARCO SAG RIVER	38	81.5	N	N	N
ARCO SPIRIT	21	19.0	Y	N	N
ARCO TEXAS	35	88.5	N	N	N
ARCTIC OCEAN	22	100.0	N	N	N
ARCTIC SUN	105	19.0	Y	Y	Y
ARCTIC UNIVERSAL	119	100.0	N	N	N
ARGONAUT	109	46.7	Y	Y	Y
ARKONA	1	100.0	N	N	N
ARKTIS LIGHT	184	85.3	Y	Y	Y
ARMCO	68	22.0	Y	Y	Y
ARTHUR M. ANDERSON	151	84.7	Y	Y	Y
ARTHUR MAERSK	45	17.7	Y	Y	Y
ASIAN SENATOR	52	100.0	N	N	N
ATIGUN PASS	75	53.3	Y	Y	Y
ATLANTA BAY	64	100.0	N	N	N
ATLANTIC	641	100.0	N	N	N
ATLANTIC COMPASS	94	100.0	N	N	N
ATLANTIC COMPANION	33	100.0	N	N	N
ATLANTIC CONCERT	42	100.0	N	N	N
ATLANTIC CONVEYOR	10	100.0	N	N	N
ATLANTIC ERIE	160	100.0	N	N	N
ATLANTIC HURON	163	100.0	N	N	N
ATLANTIC OCEAN	87	89.6	Y	Y	Y
ATLANTIC STAR	49	85.7	Y	Y	Y
ATLANTIC SUPERIOR	147	100.0	N	N	N
ATLANTIS II	2	100.0	N	N	N
AUCKLAND STAR	49	100.0	N	N	N
AUTHOR	34	100.0	N	N	N
AVILA STAR	87	100.0	N	N	N
AXEL MAERSK	191	75.3	N	N	N
B.T. ALASKA	52	100.0	N	N	N
BALIKESIR	33	0.0	N	N	N
BALTIMORE TRADER	4	50.0	Y	N	N
BAR' ZAN	37	70.2	N	N	N
BARBARA ANDRIE	64	42.1	Y	Y	Y
BARRINGTON ISLAND	28	100.0	N	N	N
BAUCHI	125	84.8	Y	Y	Y

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
BAY BRIDGE	133	39.8	Y	Y	Y
BEBEDOURO	42	100.0	N	N	N
BELGRANO	108	75.0	N	N	N
BELLONA	168	97.0	Y	Y	Y
BERGEN ARROW	48	100.0	N	N	N
BERNARDO QUINTANA A	111	84.6	Y	Y	Y
BLACK SEA	18	100.0	N	N	N
BLUE RIDGE	90	72.2	Y	Y	Y
BOGASARI LIMA	62	100.0	N	N	N
BONN EXPRESS	441	100.0	N	N	N
BOSPORUS BRIDGE	165	90.9	Y	N	N
BP ADMIRAL	81	100.0	N	N	N
BP ADVENTURE	122	100.0	N	N	N
BRAZILIAN REEFER	91	100.0	N	N	N
BREMEN EXPRESS	113	100.0	N	N	N
BRISBANE STAR	50	100.0	N	N	N
BROOKLYN BRIDGE	54	81.4	Y	Y	Y
BRUCE SMART	41	100.0	N	N	N
BUCKEYE	346	68.7	Y	Y	Y
BUFFALO SOLDIER	42	0.0	N	N	N
BUNGA SAGA TIGA	259	94.2	N	N	N
BURNS HARBOR	402	86.0	Y	Y	Y
CALCITE II	174	93.6	Y	Y	Y
CALIFORNIA CERES	72	100.0	N	N	N
CALIFORNIA CURRENT	144	100.0	N	N	N
CALIFORNIA HERMES	160	21.8	Y	Y	Y
CALIFORNIA LUNA	36	100.0	N	N	N
CALIFORNIA MERCURY	184	100.0	N	N	N
CALIFORNIA ORION	163	56.4	Y	Y	Y
CALIFORNIA PEGASUS	62	100.0	N	N	N
CALIFORNIA SATURN	46	100.0	N	N	N
CALIFORNIA STAR	92	100.0	N	N	N
CALIFORNIA TRITON	76	90.7	Y	N	N
CALIFORNIA ZEUS	22	100.0	N	N	N
CALVIN P. TITUS	21	100.0	N	N	N
CANADIAN LIBERTY	52	76.9	Y	Y	N
CAPE CHARLES	53	100.0	N	N	N
CAPE DIAMOND	20	100.0	N	N	N
CAPE HENRY	30	100.0	N	N	N
CAPE HORN	1	100.0	N	N	N
CAPE MAY	101	100.0	N	N	N
CAPE MOHICAN	33	12.1	N	N	N
CAPE ORLANDO	32	56.2	Y	N	N
CAPE RACE	15	40.0	N	N	N
CAPE RISE	2	100.0	N	N	N
CAPE WASHINGTON	43	6.9	Y	Y	Y
CAPE WRATH	29	100.0	N	N	N
CARLA A. HILLS	132	86.3	Y	N	N
CARMEL	105	23.8	N	N	N
CAROLINA	110	66.3	Y	Y	Y
CASON J. CALLAWAY	181	82.3	Y	Y	Y
CASTOR	87	100.0	N	N	N
CCNI ATACAMA	89	93.2	Y	Y	Y
CELEBRATION	3	100.0	N	N	N
CENTURY HIGHWAY #2	70	100.0	N	N	N
CENTURY HIGHWAY NO. 1	34	100.0	N	N	N
CENTURY HIGHWAY NO. 5	127	100.0	N	N	N
CENTURY HIGHWAY_NO. 3	17	100.0	N	N	N
CENTURY LEADER NO. 1	85	100.0	N	N	N
CHARLES ISLAND	117	81.1	Y	N	N
CHARLES LYKES	87	100.0	N	N	N
CHARLES M. BEEGHLEY	147	63.2	Y	Y	Y
CHARLES PIGOTT	136	0.0	N	N	N
CHARLESTON	3	100.0	N	N	N
CHASTINE MAERSK	30	0.0	Y	Y	N
CHC NO.1	36	100.0	N	N	N
CHEMICAL PIONEER	55	100.0	N	N	N
CHEMICAL RUBI	37	100.0	N	N	N
CHERRY VALLEY	1	100.0	N	N	N
CHESAPEAKE BAY	132	100.0	N	N	N
CHESAPEAKE TRADER	100	100.0	N	N	N
CHESTNUT HILL	42	23.8	N	N	N
CHEVRON ARIZONA	3	100.0	N	N	N
CHEVRON ATLANTIC	78	0.0	Y	Y	Y
CHEVRON COLORADO	57	70.1	Y	Y	Y
CHEVRON EDINBURGH	257	51.3	Y	N	N
CHEVRON EMPLOYEE PRIDE	223	4.0	Y	Y	Y
CHEVRON MARINER	68	0.0	Y	Y	N
CHEVRON MISSISSIPPI	14	85.7	N	N	N
CHEVRON OREGON	19	63.1	N	N	N
CHEVRON PACIFIC	99	38.3	Y	Y	Y
CHEVRON PERTH	18	100.0	N	N	N
CHEVRON SOUTH AMERICA	159	0.6	Y	Y	Y
CHEVRON WASHINGTON	23	52.1	N	N	N
CHILEAN EXPRESS	9	100.0	N	N	N
CHINA HOPE	64	100.0	N	N	N
CHINA PRIDE	5	0.0	N	N	N
CHINA SPIRIT	36	100.0	N	N	N
CHIQUITA BELGIE	148	100.0	N	N	N
CHIQUITA BOCAS	166	100.0	N	N	N
CHIQUITA DEUTSCHLAND	161	100.0	N	N	N
CHIQUITA FRANCES	241	100.0	N	N	N
CHIQUITA ITALIA	199	100.0	N	N	N
CHIQUITA JEAN	144	100.0	N	N	N
CHIQUITA KING	3	100.0	N	N	N
CHIQUITA NEDERLAND	129	100.0	N	N	N
CHIQUITA SCANDINAVIA	96	100.0	N	N	N
CHIQUITA SCHWEIZ	139	100.0	N	N	N
CHOAPA	25	100.0	N	N	N
CHOYANG PRIDE	39	100.0	N	N	N
CHRISTIANE	29	100.0	N	N	N
CIELO DI FIRENZE	80	100.0	N	N	N
CLEVELAND	78	100.0	N	N	N
CLIFFORD MAERSK	79	93.6	Y	Y	Y
CO-OP EXPRESO	29	0.0	N	N	N
COAST RANGE	43	55.8	N	N	N
COASTAL EAGLE POINT	6	100.0	N	N	N
COASTAL MANATEE	20	65.0	Y	N	N
COLORADO	25	96.0	Y	N	N
COLUMBIA BAY	129	100.0	N	N	N
COLUMBIA STAR	380	87.6	N	N	N
COLUMBINE	150	100.0	N	N	N
COLUMBUS AMERICA	93	100.0	N	N	N
COLUMBUS AUSTRALIA	177	100.0	N	N	N
COLUMBUS CALIFORNIA	179	100.0	N	N	N
COLUMBUS CANADA	201	100.0	N	N	N
COLUMBUS NEW ZEALAND	95	100.0	N	N	N
COLUMBUS QUEENSLAND	135	100.0	N	N	N
COLUMBUS VICTORIA	218	100.0	N	N	N
CONDOLEEZZA RICE	87	29.8	Y	Y	N
CONTIENTAL WING	120	100.0	N	N	N
CONTSHIP AMERICA	33	100.0	N	N	N
CONTSHIP ENGLAND	2	100.0	N	N	N
CORNELIS VEROLME	62	100.0	N	N	N
CORNUCOPIA	109	73.3	Y	Y	Y
CORONADO	24	45.8	Y	Y	N
CORPUS CHRISTI	47	100.0	N	N	N
CORWITH CRAMER	10	30.0	N	N	N
COURIER	73	100.0	N	N	N
COURTNEY BURTON	265	80.7	Y	Y	Y
COURTNEY L.	163	90.1	Y	Y	Y
CPL. LOUIS J. HAUGE JR	16	68.7	Y	Y	N
CRIMMITSCHAU	63	100.0	N	N	N
CRISTINA 1	19	100.0	N	N	N
CRISTOFORO COLOMBO	83	36.1	Y	Y	Y
CROWN PRINCESS	22	100.0	N	N	N
CSK UNITY	134	55.2	Y	Y	Y
CSL ATLAS	48	100.0	N	N	N
CSL CABO	5	100.0	N	N	N
CSS HUDSON	281	100.0	N	N	N
DAN MOORE	2	100.0	N	N	N
DAVID Z. NORTON	125	85.6	N	N	N
DEL MONTE CONSUMER	15	73.3	Y	Y	N
DEL MONTE PACKER	51	100.0	N	N	N
DEL MONTE TRADER	90	0.0	Y	Y	Y
DELAWARE TRADER	149	83.8	Y	Y	Y
DELMONTE PLANTER	90	11.1	Y	Y	Y
DELMONTE TRANSPORTER	63	90.4	Y	Y	Y

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
DENALI	176	88.0	Y	Y	Y
DEPPE FLORIDA	191	100.0	N	N	N
DG COLUMBIA	305	63.9	Y	Y	Y
DIAMOND STATE	16	0.0	N	N	N
DIRECT EAGLE	94	100.0	N	N	N
DIRECT FALCON	90	100.0	N	N	N
DIRECT KEA	149	100.0	N	N	N
DIRECT KIWI	158	77.2	Y	Y	N
DIRECT KOOKABURRA	176	73.8	Y	Y	Y
DOCK EXPRESS 10	111	100.0	N	N	N
DOCK EXPRESS 20	93	100.0	N	N	N
DOCTOR LYKES	22	100.0	N	N	N
DOLPHIN IV	17	100.0	N	N	N
DOROTHEA OLDENDORFF	7	100.0	N	N	N
DOUBLE GLORY	43	100.0	N	N	N
DSR BALTIC	174	100.0	N	N	N
DSR EUROPE	155	100.0	N	N	N
DSR PACIFIC	104	100.0	N	N	N
DUSSELDORF EXPRESS	300	100.0	N	N	N
DYVI OCEANIC	175	100.0	N	N	N
E.P. LE QUEBECOIS	31	100.0	N	N	N
EARL W. OGLEBAY	16	62.5	Y	Y	N
EASTERN LION	17	100.0	N	N	N
ECSTASY	73	82.1	Y	Y	N
EDELWIESS	141	76.5	Y	Y	Y
EDGAR B. SPEER	168	87.5	Y	Y	Y
EDINBURGH FRUID	66	100.0	N	N	N
EDWIN H. GOTT	432	92.5	Y	Y	Y
EDYTH L.	63	93.6	Y	Y	Y
EIBE OLDENDORFF	88	89.7	Y	Y	N
ELENORE	16	0.0	N	N	N
ELLEN HUDIG	15	100.0	N	N	N
ELLEN KNUDSEN	54	100.0	Y	Y	Y
ELLENSBORG	48	0.0	Y	Y	Y
ELSBORG	28	0.0	N	N	N
EMPIRE STATE	41	100.0	N	N	N
ENTERPRISE	50	100.0	N	N	N
ERIC G. GIBSON	25	100.0	N	N	N
ERICKSON ARCTIC	1	100.0	N	N	N
EUROPEAN SENATOR	23	100.0	N	N	N
EVER GAINING	32	100.0	N	N	N
EVER GALLANT	7	100.0	N	N	N
EVER GARLAND	18	100.0	N	N	N
EVER GATHER	10	100.0	N	N	N
EVER GENTLE	6	100.0	N	N	N
EVER GIANT	8	50.0	Y	Y	N
EVER GIVEN	40	25.0	N	N	N
EVER GLAMOUR	18	100.0	N	N	N
EVER GLEAMY	2	0.0	N	N	N
EVER GLOBE	3	100.0	N	N	N
EVER GLORY	17	70.5	N	N	N
EVER GOVERN	21	47.6	Y	N	N
EVER GRADE	13	100.0	N	N	N
EVER GROWTH	5	100.0	N	N	N
EVER GUARD	12	100.0	N	N	N
EVER GUIDE	2	100.0	N	N	N
EVER LINKING	8	100.0	N	N	N
EVER RESULT	1	0.0	N	N	N
EVER REWARD	35	100.0	N	N	N
EVER ROUND	4	0.0	Y	N	N
EWA	167	76.0	Y	Y	Y
EXCELSIOR	230	100.0	N	N	N
EXPORT FREEDOM	135	33.3	Y	Y	Y
EXPORT PATRIOT	109	26.6	Y	Y	Y
FAIRLIFT	17	100.0	N	N	N
FALSTRIA	65	100.0	N	N	N
FANTASY	11	90.9	Y	Y	N
FARALLON ISLAND	324	100.0	N	N	N
FASCINATION	66	78.7	Y	Y	Y
FAUST	120	36.6	Y	Y	Y
FERIDA	7	85.7	Y	N	N
FERNCROFT	170	65.2	Y	Y	N
FETISH	194	100.0	N	N	N
FIDELIO	114	52.6	Y	Y	Y

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
FIR GROVE	73	53.4	Y	N	N
FLORAL LAKE	5	100.0	N	N	N
FOREST CHAMPION	35	51.4	N	N	N
FOREST HAWK	118	87.2	Y	Y	Y
FRANCES HAMMER	105	78.0	Y	Y	N
FRANCES L.	87	82.7	Y	Y	Y
FRED R. WHITE JR	169	82.8	Y	Y	Y
FREJA SVEA	36	97.2	N	N	N
FRINES	53	100.0	N	N	N
GALVESTON BAY	342	40.9	Y	Y	Y
GEORGE A. SLOAN	79	83.5	Y	Y	Y
GEORGE A. STINSON	140	72.1	Y	Y	Y
GEORGE H. WEYERHAEUSER	47	100.0	N	N	N
GEORGE SCHULTZ	51	100.0	N	N	N
GEORGE WASHINGTON BRID	210	87.6	Y	Y	Y
GEORGIA RAINBOW II	255	92.1	Y	Y	N
GERONIMO	1	100.0	N	N	N
GINGA MARU	81	100.0	N	N	N
GLOBAL LINK	5	100.0	N	N	N
GLOBAL MARINER	22	0.0	Y	Y	N
GLORIOUS SUN	26	100.0	N	N	N
GOLDEN APO	25	96.0	Y	N	N
GOLDEN GATE	26	34.6	N	N	N
GREAT LAKE	22	100.0	N	N	N
GREAT LAND	53	83.0	Y	Y	Y
GREEN BAY	70	51.4	N	N	N
GREEN HARBOUR	42	35.7	Y	Y	Y
GREEN ISLAND	66	56.0	N	N	N
GREEN LAKE	254	35.8	Y	Y	Y
GREEN MAYA	150	30.0	Y	Y	N
GREEN RAINIER	56	19.6	Y	Y	Y
GREEN RIDGE	149	0.0	Y	Y	Y
GREEN SASEBO	43	41.8	Y	Y	Y
GREEN SUMA	199	7.5	Y	Y	Y
GREEN SYLVAN	6	100.0	N	N	N
GREEN WAVE	99	51.5	Y	Y	Y
GROWTH RING	155	100.0	N	N	N
GUANAJUATO	104	46.1	Y	Y	N
GUAYAMA	65	80.0	Y	N	N
GULF CURRENT	181	100.0	N	N	N
GULF SPIRIT	26	100.0	N	N	N
GULL ARROW	56	100.0	N	N	N
GYPSUM BARON	131	100.0	N	N	N
GYPSUM KING	186	100.0	N	N	N
H. LEE WHITE	121	38.8	Y	Y	Y
HANDY LOGGER	115	51.3	Y	Y	Y
HANJIN BARCELONA	33	100.0	N	N	N
HANJIN CHUNGMU	57	100.0	N	N	N
HANJIN COLOMBO	28	100.0	N	N	N
HANJIN ELIZABETH	10	100.0	N	N	N
HANJIN FELIXSTOWE	9	100.0	N	N	N
HANJIN KAOHSIUNG	13	100.0	N	N	N
HANJIN KOBE	44	97.7	N	N	N
HANJIN LE HAVRE	13	100.0	N	N	N
HANJIN MARSEILLES	37	100.0	N	N	N
HANJIN NEW YORK	29	100.0	N	N	N
HANJIN OAKLAND	14	100.0	N	N	N
HANJIN ROTTERDAM	13	84.6	N	N	N
HANJIN SAVANNAH	17	100.0	N	N	N
HANJIN SHANGHAI	14	100.0	N	N	N
HANJIN SINGAPORE	14	100.0	N	N	N
HANJIN TONGHAE	33	100.0	N	N	N
HANJIN VANCOUVER	12	100.0	N	N	N
HANJIN YOKOHAMA	42	100.0	N	N	N
HANSA LUBECK	9	100.0	N	N	N
HARBOUR BRIDGE	30	46.6	N	N	N
HARMONY ACE	3	100.0	N	N	N
HAVELLAND	195	83.0	Y	Y	Y
HAVJO	38	100.0	N	N	N
HEIDELBERG EXPRESS	270	100.0	N	N	N
HENRY HUDSON BRIDGE	128	89.8	Y	Y	N
HERBERT C. JACKSON	69	50.7	N	N	N
HERMOD	2	100.0	N	N	N
HESIOD	158	100.0	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
HOEGH CAIRN	49	24.4	Y	Y	N
HOEGH CLIPPER	24	75.0	N	N	N
HOEGH DRAKE	22	90.9	Y	N	N
HOEGH DUKE	24	33.3	N	N	N
HOEGH DYKE	48	62.5	Y	N	N
HOEGH MINERVA	105	18.0	Y	Y	N
HORIZON	92	22.8	Y	Y	Y
HOWELL LYKES	93	45.1	Y	Y	Y
HUAL ROLITA	4	100.0	N	N	N
HUMACAO	196	33.1	Y	Y	N
HYUNDAI ADMIRAL	38	68.4	N	N	N
HYUNDAI DUKE	35	97.1	Y	Y	Y
HYUNDAI EMPEROR	32	90.6	Y	Y	N
HYUNDAI LONGVIEW	137	77.3	Y	Y	Y
HYUNDAI TACOMA	162	68.5	Y	Y	Y
HYUNDAI VANCOUVER	44	100.0	N	N	N
IGARKA	26	100.0	N	N	N
IMAGINATION	117	91.4	Y	Y	Y
INDIAN GOODWILL	8	100.0	N	N	N
INDIAN OCEAN	84	66.6	Y	Y	Y
INDIANA HARBOR	14	100.0	N	N	N
INGER	44	100.0	N	N	N
IOWA TRADER	24	100.0	N	N	N
ISLA GRAN MALVINA	10	100.0	N	N	N
ISLAND BREEZE	93	82.7	Y	Y	Y
ISLAND PRINCESS	69	100.0	N	N	N
ITB BALTIMORE	137	83.9	Y	Y	Y
ITB GROTON	108	89.8	Y	Y	Y
ITB MOBILE	87	87.3	Y	Y	Y
ITB NEW YORK	65	80.0	Y	N	N
ITB PHILADELPHIA	109	0.0	Y	Y	Y
IVER EXPLORER	2	100.0	N	N	N
IVER EXPRESS	1	100.0	N	N	N
IWANUMA MARU	138	46.3	N	N	N
J. DENNIS BONNEY	57	0.0	N	N	N
JACKSONVILLE	202	93.5	Y	Y	Y
JADE STAR	7	14.2	Y	N	N
JAHRE SPIRIT	16	100.0	N	N	N
JALAGOVIND	16	100.0	N	N	N
JALISCO	33	100.0	N	N	N
JAMES LYKES	12	100.0	N	N	N
JAMES R. BARKER	218	94.9	Y	Y	Y
JAPAN RAINBOW 2	90	61.1	N	N	N
JAPAN SENATOR	61	100.0	N	N	N
JASMINE	12	100.0	N	N	N
JEAN LYKES	90	56.6	Y	Y	Y
JEBEL ALI	78	79.4	Y	Y	Y
JO CLIPPER	30	100.0	N	N	N
JO ELM	62	100.0	N	N	N
JOHN G. MUNSON	229	94.3	Y	Y	Y
JOHN J. BOLAND	40	92.5	N	N	N
JOHN PURVES	181	56.3	Y	Y	Y
JOHN YOUNG	147	0.0	Y	Y	Y
JOSEPH H. FRANTZ	31	83.8	N	N	N
JOSEPH L. BLOCK	33	72.7	N	N	N
JUBILANT	18	77.7	Y	Y	N
JUBILEE	9	100.0	N	N	N
JULIUS HAMMER	44	100.0	N	N	N
JUPITER DIAMOND	20	100.0	N	N	N
KAHO	29	0.0	Y	N	N
KAKUSHIMA	28	100.0	N	N	N
KANSAS TRADER	89	100.0	N	N	N
KAPITAN BOCHEK	1	100.0	N	N	N
KAPITAN BYANKIN	52	86.5	N	N	N
KAPITAN GNEZPILOV	94	100.0	N	N	N
KAPITAN KONEV	112	89.2	N	N	N
KAPITAN MAN	35	100.0	N	N	N
KAPITAN SERYKH	149	67.7	N	N	N
KAREN ANDRIE	21	100.0	N	N	N
KAUAI	181	49.1	Y	Y	Y
KAYE E. BARKER	175	54.2	Y	Y	Y
KAZIMAH	89	100.0	N	N	N
KEE LUNG	14	100.0	N	N	N
KENAI	227	62.9	Y	Y	Y
KENNETH E. HILL	176	68.7	Y	Y	Y
KENNETH T. DERR	67	49.2	Y	Y	Y
KENTUCKY HIGHWAY	34	100.0	N	N	N
KEYSTONE CANYON	70	54.2	Y	Y	Y
KHALEEJ BAY	141	100.0	N	N	N
KINSMAN ENTERPRISE	88	44.3	Y	N	N
KINSMAN INDEPENDENT	212	79.2	Y	Y	Y
KITTANING	49	48.9	Y	N	N
KOMSOMOLETS PRIMORYA	47	100.0	N	N	N
KONSTANTINOS A	65	63.0	N	N	N
KOPER EXPRESS	20	100.0	N	N	N
KOWLOON BAY	125	100.0	N	N	N
KURAMA	6	100.0	N	N	N
KURE	60	58.3	Y	Y	Y
LA TRINITY	60	88.3	Y	Y	Y
LADY MARYLAND	5	0.0	N	N	N
LAKE CHARLES	13	100.0	N	N	N
LAKE GUARDIAN	222	87.8	N	N	N
LAWRENCE H. GIANELLA	36	75.0	Y	Y	N
LEON	73	100.0	N	N	N
LEONIA	213	100.0	N	N	N
LERMA	43	100.0	N	N	N
LIBERTY STAR	132	50.7	Y	Y	Y
LIBERTY SUN	84	42.8	Y	Y	N
LIBERTY VICTORY	51	27.4	N	N	N
LIBERTY WAVE	44	50.0	Y	Y	N
LIHUE	106	13.2	Y	Y	Y
LIRCAY	181	64.0	N	N	N
LNG AQUARIUS	151	3.9	Y	Y	Y
LNG CAPRICORN	36	88.8	N	N	N
LNG LEO	42	80.9	Y	Y	Y
LNG TAURUS	84	67.8	Y	Y	Y
LNG VIRGO	129	0.0	Y	Y	Y
LONDON ENTERPRISE	24	100.0	N	N	N
LONDON SPIRIT	110	100.0	N	N	N
LONG BEACH	120	28.3	Y	Y	Y
LONG LINES	43	100.0	N	N	N
LOUISIANA	28	14.2	Y	N	N
LT ARGOSY	25	60.0	Y	Y	Y
LT PRAGATI	5	100.0	N	N	N
LT. ODYSSEY	71	81.6	N	N	N
LUNA MAERSK	166	88.5	N	N	N
LURLINE	193	42.4	Y	Y	Y
MACKINAC BRIDGE	140	98.5	N	N	N
MADISON MAERSK	89	58.4	Y	Y	Y
MAERSK CONSTELLATION	64	96.8	Y	N	N
MAERSK LA PLATA	165	100.0	N	N	N
MAERSK LIMA	210	84.2	Y	Y	Y
MAERSK SANTOS	60	100.0	N	N	N
MAERSK VANCOUVER	32	0.0	N	N	N
MAERSK YOKOHAMA	56	100.0	N	N	N
MAGIC	96	77.0	Y	Y	N
MAGLEBY MAERSK	68	50.0	Y	Y	Y
MAHIMAMI	213	66.1	Y	Y	Y
MAJ STEPHEN W PLESS MP	68	79.4	Y	N	N
MAJESTIC MAERSK	97	57.7	Y	Y	Y
MANGAL DESAI	27	100.0	N	N	N
MANUKAI	167	31.7	Y	Y	Y
MARCHEN MAERSK	113	43.3	Y	Y	Y
MAREN MAERSK	93	52.6	Y	Y	Y
MARGRETHE MAERSK	82	69.5	Y	Y	Y
MARIA BONITA	6	100.0	N	N	N
MARIE MAERSK	116	66.3	Y	Y	Y
MARINE RELIANCE	126	100.0	N	N	N
MARIT MAERSK	96	27.0	Y	Y	Y
MARITIME FIDELITY	33	100.0	N	N	N
MARITIME TRAINING CENT	13	100.0	N	N	N
MARK HANNAH	24	41.6	N	N	N
MARLIN	176	0.0	Y	Y	Y
MARTHA II	57	100.0	N	N	N
MASSACHUSETTS	20	100.0	N	N	N
MATHILDE MAERSK	103	45.6	Y	Y	Y

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
MATSONIA	218	44.0	Y	Y	Y
MAUI	211	56.8	Y	Y	Y
MAURICE EWING	155	30.9	Y	Y	Y
MAYAGUEZ	11	36.3	Y	N	N
MAYVIEW MAERSK	81	60.4	Y	Y	Y
MC-KINNEY MAERSK	130	54.6	Y	Y	Y
MEARSK NEWARK	68	42.6	Y	Y	Y
MEDALLION	117	94.8	Y	Y	Y
MEDUSA CHALLENGER	423	84.8	Y	Y	Y
MELBOURNE STAR	6	100.0	N	N	N
MELVILLE	88	88.6	Y	N	N
MERCHANT PREMIER	115	100.0	N	N	N
MERCHANT PRINCE	83	100.0	N	N	N
MERCHANT PRINCIPAL	108	100.0	N	N	N
MERCURY DIAMOND	93	100.0	N	N	N
MERIDA	34	100.0	N	N	N
MERIDIAN	40	0.0	Y	Y	N
MERLION ACE	54	90.7	Y	Y	Y
MESABI MINER	153	91.5	Y	Y	Y
METTE MAERSK	74	40.5	Y	Y	Y
MICHELLE	129	98.4	Y	N	N
MICHIGAN	342	41.8	Y	Y	Y
MIDDLETOWN	137	51.0	Y	Y	Y
MILDBURG	188	100.0	N	N	N
MINERAL OSPREY	126	90.4	Y	Y	Y
MING PLEASURE	76	100.0	N	N	N
MING PROPITIOUS	42	100.0	N	N	N
MINT THRUST	59	0.0	Y	Y	N
MITLA	204	100.0	N	N	N
MOANA PACIFIC	101	100.0	N	N	N
MOANA WAVE	88	100.0	N	N	N
MOKIHANA	189	68.7	Y	Y	Y
MOKU PAHU	169	36.0	Y	Y	Y
MONOA	184	54.8	Y	Y	Y
MONTERREY	143	100.0	N	N	N
MORELOS	311	64.6	Y	Y	Y
MORMACSKY	11	9.0	Y	N	N
MORMACSTAR	52	100.0	N	N	N
MORMACSUN	98	54.0	N	N	N
MOSEL ORE	246	96.3	Y	Y	Y
MSC MAUREEN	131	85.4	Y	Y	Y
MT. CABRITE	94	100.0	N	N	N
MYRON C. TAYLOR	240	85.4	Y	Y	Y
MYSTIC	2	100.0	N	N	N
NACIONAL VITORIA	46	100.0	N	N	N
NARA	70	68.5	Y	Y	Y
NATIONAL DIGNITY	31	100.0	Y	N	N
NATIONAL HONOR	38	92.1	Y	Y	Y
NATIONAL PRIDE	124	20.1	N	N	N
NAUTICAS MEXICO	69	100.0	N	N	N
NEDLLOYD DELFT	34	100.0	N	N	N
NEDLLOYD HOLLAND	121	45.4	Y	Y	Y
NEDLLOYD MAAS	25	100.0	N	N	N
NEDLLOYD RALEIGH BAY	12	100.0	N	N	N
NEDLLOYD ROTTERDAM	102	100.0	N	N	N
NEDLLOYD VAN CLOON	118	100.0	N	N	N
NEDLLOYD VAN DAJIMA	5	100.0	N	N	N
NEDLLOYD VAN DIEMEN	108	100.0	N	N	N
NEDLLOYD VAN NECK	30	100.0	N	N	N
NEDLLOYD VAN NOORT	110	100.0	N	N	N
NEPTUNE ACE	126	100.0	N	N	N
NEPTUNE AMBER	33	100.0	N	N	N
NEPTUNE CORAL	32	100.0	N	N	N
NEPTUNE CRYSTAL	10	100.0	N	N	N
NEPTUNE DIAMOND	44	61.3	N	N	N
NEPTUNE GARNET	30	100.0	N	N	N
NEPTUNE JADE	27	100.0	N	N	N
NEPTUNE PEARL	30	100.0	N	N	N
NEPTUNE RHODONITE	10	100.0	N	N	N
NEW CRYSTAL	27	100.0	N	N	N
NEW CARISSA	10	100.0	N	N	N
NEW HORIZON	96	93.7	Y	Y	Y
NEW NIKKI	149	66.4	N	N	N
NEW NOBLE	1	100.0	N	N	N
NEWARK BAY	115	96.5	Y	N	N
NEWPORT BRIDGE	49	100.0	N	N	N
NIEUW AMSTERDAM	8	100.0	N	N	N
NOAA DAVID STARR JORDA	83	28.9	Y	Y	Y
NOAA SHIP ALBATROSS IV	191	90.0	Y	Y	Y
NOAA SHIP CHAPMAN	112	21.4	Y	N	N
NOAA SHIP DISCOVERER O	418	66.0	Y	Y	Y
NOAA SHIP FERREL	221	86.8	Y	Y	Y
NOAA SHIP M. BALDRIDGE	472	96.6	Y	Y	Y
NOAA SHIP MCARTHUR	474	62.6	Y	Y	Y
NOAA SHIP MILLER FREEM	593	42.6	Y	Y	Y
NOAA SHIP OREGON II	240	87.9	Y	Y	N
NOAA SHIP RAINIER	213	87.7	Y	Y	Y
NOAA SHIP SURVEYOR	264	62.8	Y	Y	Y
NOAA SHIP T. CROMWELL	420	74.5	Y	Y	Y
NOBEL STAR	115	100.0	N	N	N
NOL RUBY	25	100.0	N	N	N
NOL TOPAZ	4	100.0	N	N	N
NOMZI	487	70.6	Y	Y	Y
NORD JAHRE TARGET	58	100.0	N	N	N
NORD JAHRE TRANSPORTER	110	100.0	N	N	N
NORDMAX	64	100.0	N	N	N
NORTHERN LIGHTS	211	78.6	N	N	N
NORTHERN LION	76	100.0	N	N	N
NORWAY	196	49.4	Y	Y	Y
NOSAC CEDAR	49	100.0	N	N	N
NOSAC RANGER	152	63.8	Y	Y	Y
NOSAC STAR	14	100.0	N	N	N
NOSAC TAKAYAMA	218	53.6	Y	Y	Y
NUEVO LEON	107	95.3	Y	Y	Y
NUEVO SAN JUAN	61	100.0	N	N	N
NURNBERG EXPRESS	646	100.0	N	N	N
NYK SEABREEZE	102	100.0	N	N	N
NYK SPRINGTIDE	133	100.0	N	N	N
NYK STARLIGHT	66	100.0	N	N	N
NYK SUNRISE	146	100.0	N	N	N
NYK SURFWIND	43	100.0	N	N	N
OAXACA	142	100.0	N	N	N
OBO ELIF	100	5.0	Y	Y	Y
OBO ENGIN	37	0.0	N	N	N
OCEAN HIGHWAY	9	100.0	N	N	N
OCEAN LAUREL	120	15.8	Y	Y	Y
OCEAN ORCHID	33	100.0	N	N	N
OCEAN SPIRIT	180	100.0	N	N	N
OCEANBREEZE	126	70.6	Y	N	N
OCEANUS OSAKA	70	32.8	Y	Y	Y
ODELIA	81	49.3	Y	Y	Y
OLEANDER	163	66.2	Y	Y	Y
OLIVE ACE	21	85.7	Y	N	N
OLIVEBANK	119	100.0	N	N	N
OLYMPIAN HIGHWAY	4	100.0	N	N	N
OMI WABASH	1	100.0	N	N	N
OMI WILLAMETTE	3	100.0	N	N	N
OOCL BRAVERY	110	100.0	N	N	N
OOCL CALIFORNIA	17	100.0	N	N	N
OOCL EDUCATOR	104	86.5	Y	Y	Y
OOCL ENVOY	93	100.0	N	N	N
OOCL EXPLORER	132	76.5	Y	Y	Y
OOCL FAIR	207	100.0	Y	Y	Y
OOCL FAITH	50	100.0	N	N	N
OOCL FIDELITY	116	90.5	Y	Y	Y
OOCL FORTUNE	115	99.1	Y	N	N
OOCL FREEDOM	237	100.0	N	N	N
OOCL FRIENDSHIP	50	100.0	N	N	N
OOCL INNOVATION	102	72.5	N	N	N
OOCL INSPIRATION	145	100.0	Y	N	N
ORANGE BLOSSOM	44	38.6	N	N	N
ORANGE STAR	4	100.0	N	N	N
ORANGE WAVE	47	0.0	Y	Y	Y
OREGON RAINBOW III	106	40.5	N	N	N
ORIENTE PRIME	52	50.0	Y	Y	Y
ORION HIGHWAY	105	53.3	Y	Y	Y
OSAKA BAY	108	100.0	N	N	N
OURO DO BRASIL	37	100.0	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
OVERSEAS ALASKA	65	21.5	Y	Y	Y
OVERSEAS ARCTIC	40	50.0	Y	Y	N
OVERSEAS HARRIET	17	100.0	N	N	N
OVERSEAS JOYCE	104	51.9	Y	Y	N
OVERSEAS MARILYN	34	100.0	N	N	N
OVERSEAS NEW ORLEANS	46	100.0	N	N	N
OVERSEAS OHIO	15	60.0	Y	N	N
PACASIA	38	92.1	Y	N	N
PACDUKE	82	100.0	N	N	N
PACIFIC ARIES	103	100.0	N	N	N
PACIFIC PRINCESS	59	100.0	N	N	N
PACMERCHANT	13	100.0	N	N	N
PACPRINCE	25	100.0	N	N	N
PACPRINCESS	20	100.0	N	N	N
PACSEA	38	100.0	N	N	N
PACSUN	47	100.0	N	N	N
PADRONE	172	100.0	N	N	N
PALMGRACHT	102	100.0	N	N	N
PAPAGO	18	72.2	Y	Y	N
PATRIOT	76	100.0	N	N	N
PAUL BUCK	19	94.7	N	N	N
PAUL H. TOWNSEND	56	82.1	Y	Y	Y
PAUL R. TREGURTHA	381	93.4	Y	Y	Y
PEARL ACE	135	100.0	N	N	N
PEGGY DOW	111	100.0	N	N	N
PETER W. ANDERSON	42	35.7	Y	Y	Y
PETROBULK RACER	42	2.3	Y	Y	Y
PFC DEWAYNE T. WILLIAM	37	64.8	Y	Y	N
PFC EUGENE A. OBREGON	90	53.3	Y	Y	Y
PFC JAMES ANDERSON JR	67	43.2	Y	N	N
PFC WILLIAM B. BAUGH	101	55.4	N	N	N
PHAROS	74	100.0	N	N	N
PHILIP R. CLARKE	48	87.5	Y	N	N
PIERRE FORTIN	617	100.0	N	N	N
PISCES EXPLORER	64	100.0	N	N	N
PISCES PIONEER	125	100.0	N	N	N
PISCES PLANTER	103	100.0	N	N	N
PLATTE	18	100.0	N	N	N
POLAR EAGLE	131	12.2	Y	Y	Y
POLYNESIA	150	97.3	Y	N	N
POOLGRACHT	181	100.0	N	N	N
POROS	59	84.7	Y	Y	Y
POTOMAC TRADER	16	100.0	N	N	N
POYANG	161	100.0	N	N	N
POYARKOVO	39	100.0	N	N	N
PRESIDENT ADAMS	179	69.8	Y	Y	Y
PRESIDENT ARTHUR	112	33.0	Y	Y	N
PRESIDENT BUCHANAN	146	10.9	N	N	N
PRESIDENT EISENHOWER	181	43.0	Y	Y	Y
PRESIDENT F. ROOSEVELT	198	66.6	Y	Y	Y
PRESIDENT GARFIELD	47	34.0	Y	Y	N
PRESIDENT GRANT	83	54.2	Y	Y	Y
PRESIDENT HARDING	156	79.4	Y	Y	Y
PRESIDENT HARRISON	98	100.0	N	N	N
PRESIDENT JACKSON	153	5.2	N	N	N
PRESIDENT KENNEDY	176	78.9	Y	Y	Y
PRESIDENT POLK	218	80.2	N	N	N
PRESIDENT TRUMAN	151	59.6	Y	Y	Y
PRESQUE ISLE	242	83.8	Y	Y	Y
PRIDE OF BALTIMORE II	63	100.0	N	N	N
PRINCE OF OCEAN	231	30.7	Y	Y	Y
PRINCE OF TOKYO	108	69.4	Y	Y	N
PRINCE WILLIAM SOUND	136	44.1	Y	Y	Y
PRINCESS DIAN	11	100.0	N	N	N
PROJECT ORIENT	84	100.0	N	N	N
PUERTO CORTES	14	100.0	N	N	N
PVT FRANKLIN J. PHILLI	100	55.0	N	N	N
PYTCHLEY	232	100.0	N	N	N
QUALITY OF LIFE	7	100.0	N	N	N
QUEEN ELIZABETH 2	187	100.0	N	N	N
QUEENSLAND STAR	219	100.0	N	N	N
R. HAL DEAN	75	90.6	N	N	N
R.J. PFEIFFER	141	62.4	Y	Y	Y
RANGER	23	100.0	N	N	N
RANI PADMINI	49	100.0	N	N	N
RECIFE	11	100.0	N	N	N
REGAL EMPRESS	37	72.9	Y	Y	Y
REGAL PRINCESS	65	90.7	N	N	N
REGINA J	91	100.0	N	N	N
REPULSE BAY	167	100.0	N	N	N
RESERVE	143	72.0	Y	Y	Y
RESOLUTE	119	22.6	Y	Y	Y
RHINE FOREST	166	56.6	Y	N	N
RICHARD G MATTIESEN	59	59.3	Y	Y	Y
RICHARD REISS	48	87.5	Y	Y	Y
RICHMOND BAY	113	100.0	N	N	N
ROBERT E. LEE	67	50.7	Y	Y	N
ROCKIES HIGHWAY	6	100.0	N	N	N
ROGER BLOUGH	218	92.2	Y	Y	Y
ROSINA TOPIC	130	1.5	Y	Y	Y
ROSITA	58	77.5	Y	Y	Y
ROVER	1	100.0	N	N	N
ROYAL MAJESTY	95	0.0	Y	Y	Y
ROYAL PRINCESS	48	100.0	N	N	N
RUBIN KOBE	3	100.0	N	N	N
RUBIN STAR	51	74.5	N	N	N
RUBIN STELLA	46	21.7	Y	N	N
S.T. CRAPO	99	88.8	Y	Y	Y
S/S WILSON	50	50.0	Y	N	N
SABINE	1	100.0	N	N	N
SALINAS	25	100.0	N	N	N
SALOME	141	78.0	Y	Y	N
SAM HOUSTON	62	38.7	Y	N	N
SAMUEL GINN	13	92.3	Y	N	N
SAMUEL H. ARMACOST	110	59.0	Y	Y	Y
SAMUEL L. COBB	5	100.0	N	N	N
SAMUEL RISLEY	139	100.0	N	N	N
SAN ISIDRO	80	100.0	N	N	N
SAN LAUREL	130	56.9	Y	Y	N
SAN MARCOS	122	13.9	Y	Y	Y
SAN VINCENTE	70	100.0	N	N	N
SANKO LAUREL	41	51.2	Y	N	N
SANKO POPPY	155	40.6	Y	Y	Y
SANKO SOUTH	55	100.0	N	N	N
SANKO SPLENDOUR	36	100.0	N	N	N
SANKO SPRUCE	149	35.5	N	N	N
SANTA FE DE BOGOTA	53	100.0	N	N	N
SANTA MONICA	54	100.0	N	N	N
SANTORIN 2	438	10.0	Y	Y	Y
SARAJEVO EXPRESS	31	100.0	N	N	N
SAUDI HAIL	5	100.0	N	N	N
SAVANNAH	95	100.0	N	N	N
SEA COMMERCE	166	52.4	Y	Y	Y
SEA EXCELLENCE	113	92.0	Y	N	N
SEA FLORIDA	157	88.5	Y	Y	Y
SEA FOX	145	96.5	Y	Y	Y
SEA ISLE CITY	52	100.0	N	N	N
SEA LION	439	82.4	Y	Y	Y
SEA MARINER	106	58.4	N	N	N
SEA MERCHANT	360	95.5	Y	Y	Y
SEA NOVIA	1	100.0	N	N	N
SEA PREMIER	145	100.0	N	N	N
SEA PRINCESS	21	100.0	N	N	N
SEA SPRAY	22	100.0	N	N	N
SEA TRADE	162	85.8	Y	Y	Y
SEA WOLF	216	88.8	Y	Y	Y
SEABOARD OCEAN	1	100.0	N	N	N
SEABOARD SUN	119	0.0	Y	Y	Y
SEABOARD UNIVERSE	47	76.5	N	N	N
SEABREEZE I	10	100.0	N	N	N
SEALAND ANCHORAGE	123	40.6	Y	Y	Y
SEALAND ATLANTIC	80	100.0	N	N	N
SEALAND CHALLENGER	206	30.0	Y	Y	Y
SEALAND CHAMPION	187	46.5	Y	Y	Y
SEALAND CONSUMER	20	100.0	N	N	N
SEALAND COSTA RICA	110	76.3	Y	Y	Y
SEALAND CRUSADER	113	88.4	Y	Y	Y
SEALAND DEFENDER	208	46.6	Y	Y	Y

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
SEALAND DEVELOPER	137	52.5	Y	Y	Y
SEALAND DISCOVERY	165	53.9	Y	Y	Y
SEALAND ENDURANCE	133	42.8	Y	Y	Y
SEALAND ENTERPRISE	258	64.3	Y	N	N
SEALAND EXPEDITION	20	10.0	Y	Y	Y
SEALAND EXPLORER	163	77.3	Y	Y	Y
SEALAND EXPRESS	141	100.0	N	N	N
SEALAND HAWAII	175	89.7	Y	Y	Y
SEALAND INDEPENDENCE	193	35.7	Y	Y	Y
SEALAND INNOVATOR	65	27.6	Y	Y	Y
SEALAND INTEGRITY	135	94.8	N	N	N
SEALAND KODIAK	23	100.0	N	N	N
SEALAND LIBERATOR	144	44.4	Y	Y	Y
SEALAND MARINER	6	100.0	N	N	N
SEALAND NAVIGATOR	207	71.4	Y	Y	Y
SEALAND PACIFIC	184	85.3	Y	Y	Y
SEALAND PATRIOT	95	51.5	Y	Y	Y
SEALAND PERFORMANCE	135	72.5	Y	Y	Y
SEALAND PRODUCER	230	60.0	Y	Y	Y
SEALAND QUALITY	75	44.0	Y	Y	Y
SEALAND RELIANCE	218	59.6	N	N	N
SEALAND SPIRIT	171	45.0	Y	Y	Y
SEALAND TACOMA	141	33.3	Y	Y	Y
SEALAND TRADER	226	91.5	Y	Y	Y
SEARIVER BATON ROUGE	21	80.9	Y	Y	Y
SEARIVER BENICIA	28	75.0	Y	Y	Y
SEARIVER CHARLESTOWN	9	100.0	N	N	N
SEARIVER LONG BEACH	32	59.3	N	N	N
SEARIVER PHILADELPHIA	13	76.9	Y	Y	N
SEARIVER SAN FRANCISCO	36	88.8	Y	Y	Y
SEAWARD JOHNSON	20	70.0	Y	Y	N
SEDCO/BP 471	258	56.2	Y	Y	N
SENATOR	126	100.0	N	N	N
SENORITA	182	43.9	Y	Y	Y
SENSATION	202	67.8	Y	Y	Y
SERENITY	148	87.8	Y	Y	Y
SETO BRIDGE	192	100.0	N	N	N
SEVEN OCEAN	34	97.0	N	N	N
SGT WILLIAM A BUTTON	12	100.0	N	N	N
SGT. METEJ KOCAK	54	25.9	Y	Y	N
SHELDON LYKES	103	69.9	Y	Y	Y
SHELLY BAY	64	87.5	Y	Y	Y
SHIRAOI MARU	176	79.5	Y	Y	Y
SIBOHELLE	58	100.0	N	N	N
SIDNEY STAR	126	100.0	N	N	N
SINCERE GEMINI	80	65.0	Y	Y	Y
SKANDERBORG	1	100.0	N	N	N
SKAUBRYN	127	100.0	N	N	N
SKAUGRAN	130	100.0	N	N	N
SKODSBORG	5	100.0	N	N	N
SKOGAFOSS	115	100.0	N	N	N
SOL DO BRASIL	33	93.9	Y	N	N
SOLAR WING	51	100.0	N	N	N
SONORA	121	100.0	N	N	N
SOREN TOUBRO	34	100.0	N	N	N
SOUTHERN LION	213	100.0	N	N	N
SOUTHERN PRINCESS	179	0.0	Y	Y	Y
SOVEREIGN OF THE SEAS	65	78.4	Y	Y	Y
SPRING BEAR	19	100.0	N	N	N
ST BLAIZE	21	100.0	N	N	N
ST. CLAIR	1	100.0	N	N	N
ST. LUCIA	1	100.0	N	N	N
STAFFORDSHIRE	194	100.0	N	N	N
STAR ALABAMA	11	100.0	N	N	N
STAR AMERICA	15	100.0	N	N	N
STAR DAVANGER	64	100.0	N	N	N
STAR DROTTANGER	37	100.0	N	N	N
STAR EAGLE	2	100.0	N	N	N
STAR EVVIVA	70	100.0	N	N	N
STAR FLORIDA	55	98.1	N	N	N
STAR FRASER	122	100.0	N	N	N
STAR FUJI	48	100.0	N	N	N
STAR GEIRANGER	21	100.0	N	N	N
STAR GRAN	23	100.0	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
STAR OF MARIA	72	100.0	N	N	N
STAR SKARVEN	92	46.7	Y	Y	Y
STAR STRONEN	48	100.0	N	N	N
STELLA	57	49.1	Y	Y	Y
STELLAR BENY	28	100.0	N	N	N
STEPAN KRASHENINNIKOV	40	100.0	N	N	N
STEWART J. CORT	325	87.6	Y	Y	Y
STOLT AVENIR	115	100.0	N	N	N
STOLT CONDOR	6	100.0	N	N	N
STONEWALL JACKSON	55	54.5	Y	Y	Y
STRONG CAJUN	9	100.0	N	N	N
STRONG VIRGINIAN	182	44.5	Y	Y	Y
STUTTGART EXPRESS	1	100.0	N	N	N
SUGAR ISLANDER	47	100.0	N	N	N
SUN VIKING	11	100.0	N	N	N
SUNBELT DIXIE	25	100.0	N	N	N
SUNDA	181	100.0	N	N	N
SVEN OLTMANN	212	88.2	Y	Y	Y
SWIFTNES	98	100.0	N	N	N
TADEUSZ OCIOSZYNSKI	9	100.0	N	N	N
TAI CHUNG	8	100.0	N	N	N
TAI HE	165	100.0	N	N	N
TAI SHING	19	57.8	N	N	N
TALLAHASSEE BAY	28	100.0	N	N	N
TAMATHAI	44	100.0	N	N	N
TAMPA	15	100.0	N	N	N
TAMPA BAY	13	100.0	N	N	N
TAPIOLA	16	100.0	N	N	N
TEAL ARROW	89	94.3	Y	Y	N
TEPOZTECO II	143	100.0	N	N	N
TEQUI	63	100.0	N	N	N
THOMAS G. THOMPSON	289	16.9	Y	Y	Y
THOMPSON LYKES	76	53.9	Y	Y	N
THOMPSON PASS	3	100.0	N	N	N
TILLIE LYKES	123	39.8	Y	Y	Y
TOKIO EXPRESS	61	100.0	N	N	N
TOLUCA	100	100.0	N	N	N
TONSINA	49	38.7	Y	Y	Y
TORBEN	287	35.1	Y	Y	Y
TORM FREYA	67	100.0	N	N	N
TOWER BRIDGE	42	100.0	N	N	N
TRANSWORLD BRIDGE	143	93.0	Y	Y	Y
TRIGGER	67	59.7	Y	Y	Y
TRINITY	16	100.0	N	N	N
TRITON	371	75.4	Y	Y	Y
TROPIC DAY	26	15.3	Y	Y	Y
TROPIC FLYER	52	30.7	Y	Y	Y
TROPIC JADE	67	56.7	N	N	N
TROPIC KEY	72	16.6	Y	Y	Y
TROPIC LURE	104	53.8	Y	Y	Y
TROPIC MIST	46	0.0	Y	Y	Y
TROPIC NIGHT	2	0.0	N	N	N
TROPIC PALM	73	0.0	Y	Y	Y
TROPIC SUN	187	74.8	Y	Y	Y
TROPIC TIDE	110	72.7	Y	Y	Y
TROPICALE	3	100.0	N	N	N
TRSL ARCTURUS	88	86.3	N	N	N
TULSIDAS	3	100.0	N	N	N
TYSON LYKES	126	34.9	Y	Y	Y
ULF RITSCHER	9	100.0	N	N	N
ULLSWATER	244	100.0	N	N	N
ULTRASEA	15	100.0	N	N	N
UNIVERSE	13	100.0	N	N	N
USCGC ACACIA (WLB406)	54	59.2	Y	Y	N
USCGC ACTIVE WMEC 618	177	41.2	N	N	N
USCGC ACUSHNET WMEC 16	63	100.0	N	N	N
USCGC ALERT (WMEC 630)	201	66.1	Y	Y	Y
USCGC BASSWOOD (WLB 38	28	100.0	N	N	N
USCGC BEAR (WEMC 901)	19	100.0	N	N	N
USCGC BOUTWELL WHEC 71	64	46.8	N	N	N
USCGC BRAMBLE (WLB 392	18	77.7	Y	Y	N
USCGC BRISTOL BAY	34	70.5	N	N	N
USCGC CAMPBELL	31	67.7	N	N	N
USCGC CHASE (WHEC 718)	141	82.9	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED JUL	AUG	SEP
USCGC CONFIDENCE WMEC6	1	100.0	N	N	N
USCGC COURAGEOUS	43	100.0	N	N	N
USCGC DAUNTLESS WMEC 6	77	100.0	N	N	N
USCGC DECISIVE WMEC 62	21	100.0	N	N	N
USCGC DILIGENCE WMEC 6	29	100.0	N	N	N
USCGC DURABLE (WMEC 62	86	100.0	N	N	N
USCGC FIREBUSH WLB 393	8	100.0	N	N	N
USCGC GALLATIN	216	56.0	Y	Y	N
USCGC GENTIAN WLB 290	13	0.0	N	N	N
USCGC HAMILTON WHEC 71	8	100.0	N	N	N
USCGC HARRIET LANE	30	100.0	N	N	N
USCGC JARVIS (WHEC 725	51	100.0	N	N	N
USCGC KATMAI BAY	1	100.0	N	N	N
USCGC LEGARE	27	100.0	N	N	N
USCGC MACKINAW	4	75.0	N	N	N
USCGC MALLOW (WLB 396)	90	100.0	N	N	N
USCGC MARIPOSA	10	100.0	N	N	N
USCGC MELLON (WHEC 717	64	100.0	N	N	N
USCGC MIDGETT (WHEC 72	63	95.2	Y	Y	N
USCGC MOHAWK WMEC 913	19	100.0	N	N	N
USCGC MORGENTHAU	44	100.0	N	N	N
USCGC MUNRO	27	74.0	N	N	N
USCGC NORTHLAND WMEC 9	115	98.2	Y	N	N
USCGC PLANETREE	34	100.0	N	N	N
USCGC POLAR SEA__(WAGB	2	100.0	N	N	N
USCGC POLAR STAR (WAGB	136	100.0	N	N	N
USCGC RELIANCE WMEC 61	72	100.0	N	N	N
USCGC RUSH	103	100.0	N	N	N
USCGC SASSAFRAS	27	100.0	N	N	N
USCGC SEDGE (WLB 402)	3	100.0	N	N	N
USCGC SENECA	22	100.0	N	N	N
USCGC SHERMAN	88	86.3	N	N	N
USCGC SPENCER	55	100.0	N	N	N
USCGC STEADFAST (WMEC	110	51.8	N	N	N
USCGC STORIS (WMEC 38)	181	86.7	Y	Y	Y
USCGC SUNDEW (WLB 404)	28	100.0	N	N	N
USCGC THETIS	36	19.4	Y	Y	N
USCGC VALIANT (WMEC 62	46	76.0	Y	Y	Y
USCGC VIGILANT WMEC 61	2	100.0	N	N	N
USCGC VIGOROUS WMEC 62	106	55.6	Y	Y	Y
USCGC YOCONA (WMEC 168	68	100.0	N	N	N
USNS ALGOL	17	100.0	N	N	N
USNS ALTAIR	21	0.0	N	N	N
USNS ANTARES	64	21.8	N	N	N
USNS APACHE (T-ATF 172	75	90.6	Y	N	N
USNS BELLATRIX	14	100.0	N	N	N
USNS CAPELLA	5	80.0	Y	N	N
USNS COMFORT	2	100.0	N	N	N
USNS DENEBOLA	7	57.1	N	N	N
USNS GUADALUPE	80	100.0	N	N	N
USNS GUS W. DARNELL	30	100.0	N	N	N
USNS HAYES	69	0.0	Y	Y	Y
USNS HENRY J. KAISER	10	100.0	N	N	N
USNS JOHN ERICSSON	90	0.0	Y	Y	N
USNS JOHN LENTHALL	98	0.0	N	N	N
USNS JOHN MCDONNELL (T	23	78.2	Y	Y	N
USNS KANE TAGS 27	1	100.0	N	N	N
USNS MARS	116	100.0	N	N	N
USNS MOHAWK (T-ATF 170	57	49.1	Y	Y	Y
USNS NARRAGANSETT	111	81.9	Y	Y	Y
USNS NAVAJO_(TATF-169)	42	100.0	N	N	N
USNS OBSERVATION ISLAN	20	100.0	N	N	N
USNS PATHFINDER T-AGS	5	100.0	N	N	N
USNS PECOS	26	100.0	N	N	N
USNS POWHATAN TATF 166	98	95.9	Y	Y	Y
USNS SAN DIEGO	37	51.3	N	N	N
USNS SATURN T-AFS-10	26	0.0	Y	N	N
USNS SILAS BENT T-AGS	17	100.0	N	N	N
USNS VANGUARD TAG 194	53	92.4	Y	N	N
USNS YUKON (T-AO 202)	79	94.9	N	N	N
USS RUSSELL DDG-59	87	100.0	N	N	N
VEGA	68	100.0	N	N	N
VENUS DIAMOND	96	100.0	N	N	N
VERA ACORDE	64	9.3	Y	Y	Y
VIDAL	106	100.0	N	N	N
VINE	154	100.0	N	N	N
VIRGINIA	262	12.2	Y	Y	Y
VISAYAS VICTORY	128	0.0	Y	Y	N
VIVA	178	16.8	Y	Y	Y
WASHINGTON HIGHWAY	39	100.0	N	N	N
WAVELET	21	100.0	N	N	N
WEST MOOR	1	100.0	N	N	N
WESTERDAM	85	100.0	N	N	N
WESTERN FRIEND	146	30.8	Y	Y	Y
WESTERN LION	21	100.0	N	N	N
WESTWARD	20	5.0	Y	Y	N
WESTWARD VENTURE	200	58.0	Y	Y	Y
WESTWOOD ANETTE	136	71.3	Y	Y	Y
WESTWOOD BELINDA	41	82.9	Y	Y	Y
WESTWOOD CLEO	113	76.9	Y	Y	N
WESTWOOD FUJI	103	66.9	Y	Y	Y
WESTWOOD JAGO	162	47.5	Y	Y	Y
WESTWOOD MARIANNE	177	87.5	Y	Y	Y
WILFRED SYKES	39	87.1	Y	Y	Y
WILLIAM E. CRAIN	112	0.0	Y	Y	N
WILLIAM E. MUSSMAN	58	74.1	Y	Y	Y
YOHFU	118	14.4	Y	Y	Y
YOUNG SPROUT	32	25.0	Y	Y	N
YUCATAN	86	48.8	Y	Y	N
YURIY OSTROVSKIY	123	71.5	Y	Y	Y
YUYO BREEZE	32	75.0	N	N	N
ZAGREB EXPRESS	19	100.0	N	N	N
ZETLAND	195	100.0	N	N	N
ZIM AMERICA	139	100.0	N	N	N
ZIM CANADA	52	100.0	N	N	N
ZIM HONGKONG	5	100.0	N	N	N
ZIM IBERIA	38	100.0	N	N	N
ZIM ISRAEL	47	100.0	N	N	N
ZIM ITALIA	131	57.2	Y	Y	Y
ZIM JAPAN	37	100.0	N	N	N
ZIM KEELUNG	71	100.0	N	N	N
ZIM KOREA	74	68.9	N	N	N
ZIM SAN JUAN	180	20.5	Y	Y	Y
GRAND TOTAL	98107				
TOTAL VIA RADIO	73764				
PERCENT VIA RADIO	75.1				

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NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
ACADIA FOREST	183	45.3	Y	Y	Y
ACT 7	135	100.0	N	N	N
ACT I	162	100.0	N	N	N
ADABELLE LYKES	75	66.6	Y	N	N
ADAM E. CORNELIUS	99	67.6	Y	Y	Y
ADDIRIYAH	60	0.0	N	N	N
ADVANTAGE	103	77.6	Y	Y	Y
AGULHAS	102	93.1	N	N	N
AL AWDAH	99	100.0	N	N	N
AL SAMIDOON	270	100.0	N	N	N
AL SHUHADAA	113	100.0	N	N	N
AL TAHREER	88	100.0	N	N	N
ALASKA	146	54.7	Y	Y	Y
ALBEMARLE ISLAND	33	100.0	Y	N	N
ALBERNI DAWN	144	100.0	N	N	N
ALDEN W. CLAUSEN	80	100.0	N	N	N
ALGENIB	17	100.0	N	N	N
ALLIGATOR BRAVERY	127	88.9	Y	Y	Y
ALLIGATOR HOPE	23	100.0	Y	N	N
ALLIGATOR FORTUNE	125	100.0	N	N	N
ALLIGATOR GLORY	80	100.0	N	N	N
ALLIGATOR TRIUMPH	6	0.0	Y	Y	N
ALLIGATOR EXCELLENCE	239	82.0	Y	Y	Y

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
ALLIGATOR JOY	132	96.2	Y	Y	Y
ALLIGATOR COLUMBUS	163	97.6	Y	Y	Y
ALLIGATOR STRENGTH	150	71.3	Y	Y	Y
ALLIGATOR LIBERTY	92	100.0	N	N	N
ALLIGATOR AMERICA	67	100.0	N	N	N
ALMANIA	21	100.0	N	N	N
ALPENA	89	82.0	Y	N	N
ALTAMONTE	42	97.6	Y	Y	Y
AMALIA	47	93.6	Y	N	N
AMAZON	232	89.2	Y	Y	Y
AMBASSADOR	45	82.2	Y	Y	Y
AMER HIMALAYA	75	100.0	N	N	N
AMERICA STAR	211	100.0	N	N	N
AMERICAN CORMORANT	87	100.0	N	N	N
AMERICAN CONDOR	133	0.0	Y	Y	Y
AMERICAN FALCON	51	86.2	Y	N	N
AMERICAN OSPREY	22	100.0	N	N	N
AMERICANA	49	59.1	Y	Y	Y
AMERIGO VESPUCCI	84	47.6	Y	Y	Y
ANASTASIA	43	100.0	N	N	N
ANATOLIY KOLESNICHENKO	37	100.0	N	N	N
ANDERS MAERSK	43	76.7	Y	N	N
ANTWERPEN	30	100.0	N	N	N
ARABIAN SENATOR	101	100.0	N	N	N
ARCO ALASKA	45	0.0	Y	Y	Y
ARCO ANCHORAGE	9	0.0	N	N	N
ARCO CALIFORNIA	92	75.0	Y	Y	Y
ARCO FAIRBANKS	27	92.5	N	N	N
ARCO INDEPENDENCE	10	0.0	N	N	N
ARCO JUNEAU	20	30.0	Y	N	N
ARCO SPIRIT	3	100.0	N	N	N
ARCO TEXAS	33	78.7	N	N	N
ARCTIC OCEAN	46	86.9	Y	Y	Y
ARCTIC SUN	112	20.5	Y	Y	Y
ARCTIC UNIVERSAL	131	100.0	N	N	N
ARGONAUT	56	82.1	N	N	N
ARIES	3	100.0	N	N	N
ARIZONA	34	100.0	N	N	N
ARKONA	16	100.0	N	N	N
ARKTIS LIGHT	185	89.7	Y	Y	Y
ARMCO	5	100.0	N	N	N
ARTHUR M. ANDERSON	164	92.6	Y	Y	Y
ARTHUR MAERSK	139	94.6	N	N	N
ASIAN SENATOR	60	100.0	N	N	N
ATIGUN PASS	11	72.7	Y	N	N
ATLANTA BAY	43	100.0	N	N	N
ATLANTIC	651	100.0	N	N	N
ATLANTIC BULKER	71	0.0	Y	Y	Y
ATLANTIC CONVEYOR	7	100.0	N	N	N
ATLANTIC COMPASS	82	100.0	N	N	N
ATLANTIC CONCERT	55	100.0	N	N	N
ATLANTIC COMPANION	64	100.0	N	N	N
ATLANTIC ERIE	89	100.0	N	N	N
ATLANTIC HURON	136	100.0	N	N	N
ATLANTIC OCEAN	48	95.8	Y	Y	Y
ATLANTIC STAR	9	100.0	N	N	N
ATLANTIC SUPERIOR	163	100.0	N	N	N
AUCKLAND STAR	28	100.0	N	N	N
AUTHOR	147	100.0	N	N	N
AVILA STAR	110	100.0	N	N	N
AXEL MAERSK	170	69.4	Y	Y	Y
B.T. ALASKA	97	100.0	N	N	N
BAB' ZAN	92	81.5	Y	Y	N
BARBARA ANDRIE	34	82.3	Y	N	N
BARRINGTON ISLAND	11	100.0	N	N	N
BAUCHI	64	84.3	N	N	N
BAY BRIDGE	153	26.7	Y	Y	Y
BELORIANO	74	100.0	N	N	N
BELLONA	223	96.4	Y	Y	Y
BERGEN ARROW	15	100.0	N	N	N
BERNARDO QUINTANA A	165	80.6	Y	Y	Y
BLUE RIDGE	93	78.8	Y	Y	N
BOQASARI LIMA	139	100.0	N	N	N
BORN EXPRESS	802	100.0	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
BOSPORUS BRIDGE	109	100.0	N	N	N
BP ADMIRAL	189	100.0	N	N	N
BP ADVENTURE	94	100.0	N	N	N
BREMEN EXPRESS	62	100.0	N	N	N
BRISBANE STAR	103	100.0	N	N	N
BROOKLYN BRIDGE	119	91.5	Y	Y	Y
BRUCE SMART	103	0.0	Y	Y	N
BT NAUTILUS	32	100.0	N	N	N
BUCKEYE	301	69.1	Y	Y	Y
BUFFALO SOLDIER	112	9.8	Y	Y	Y
BUNGA SAGA TIGA	233	81.2	Y	Y	Y
BURNS HARBOR	451	82.4	Y	Y	Y
C.S. IRIS	77	100.0	N	N	N
CALCITE II	138	83.5	Y	Y	Y
CALIFORNIA ORION	159	71.0	Y	Y	Y
CALIFORNIA CERES	84	100.0	N	N	N
CALIFORNIA STAR	102	100.0	N	N	N
CALIFORNIA CURRENT	182	100.0	N	N	N
CALIFORNIA ZEUS	45	75.5	Y	N	N
CALIFORNIA HERMES	239	12.9	Y	Y	Y
CALIFORNIA MERCURY	211	100.0	N	N	N
CALIFORNIA SATURN	45	84.4	N	N	N
CALIFORNIA JUPITER	4	100.0	N	N	N
CALIFORNIA LUNA	109	100.0	N	N	N
CALIFORNIA PEGASUS	44	100.0	N	N	N
CALIFORNIA TRITON	33	100.0	N	N	N
CALVIN P. TITUS	4	100.0	N	N	N
CANADIAN LIBERTY	50	100.0	N	N	N
CAPE BREEZE	23	100.0	N	N	N
CAPE CHARLES	71	100.0	N	N	N
CAPE HENRY	33	100.0	N	N	N
CAPE MAY	87	100.0	N	N	N
CAPE MOHICAN	50	64.0	Y	Y	N
CAPE RACE	14	100.0	N	N	N
CAPE RISE	37	100.0	N	N	N
CARIBBEAN MERCY	5	100.0	N	N	N
CARLA A. HILLS	5	100.0	N	N	N
CARMEL	125	15.2	Y	Y	Y
CAROLINA	176	62.5	Y	Y	Y
CAROLINE OLDENDORFF	33	100.0	N	N	N
CASON J. CALLAWAY	209	87.0	Y	Y	Y
CASTOR	163	100.0	N	N	N
CCNI ATACAMA	106	93.3	Y	Y	Y
CELEBRATION	13	100.0	Y	Y	Y
CENTURY HIGHWAY #2	85	100.0	N	N	N
CENTURY HIGHWAY NO. 1	104	100.0	N	N	N
CENTURY HIGHWAY NO. 3	9	100.0	N	N	N
CENTURY HIGHWAY NO. 5	48	100.0	N	N	N
CENTURY LEADER NO. 1	96	100.0	N	N	N
CHARLES ISLAND	144	100.0	N	N	N
CHARLES LYKES	139	100.0	N	N	N
CHARLES M. BEEGHLEY	191	79.0	Y	Y	Y
CHARLES PIOTT	103	0.0	Y	N	N
CHASTINE MAERSK	95	92.6	Y	Y	Y
CHEMICAL PIONEER	80	100.0	N	N	N
CHEMICAL RUBI	27	100.0	N	N	N
CHERRY VALLEY	4	100.0	N	N	N
CHESAPEAKE BAY	13	100.0	N	N	N
CHESAPEAKE CITY	65	100.0	N	N	N
CHESAPEAKE TRADER	132	68.9	Y	Y	Y
CHEVRON ARIZONA	99	90.9	Y	Y	Y
CHEVRON ATLANTIC	57	0.0	N	N	N
CHEVRON COLORADO	67	92.5	Y	Y	N
CHEVRON EDINBURGH	260	63.8	Y	Y	Y
CHEVRON EMPLOYEE PRIDE	65	43.0	Y	N	N
CHEVRON MARINER	160	0.0	Y	Y	Y
CHEVRON MISSISSIPPI	55	47.2	N	N	N
CHEVRON PACIFIC	135	55.5	Y	Y	Y
CHEVRON PERTH	144	2.0	Y	Y	Y
CHEVRON SOUTH AMERICA	127	37.0	Y	N	N
CHILEAN EXPRESS	1	100.0	N	N	N
CHILEAN REEFER	7	100.0	N	N	N
CHINA HOPE	48	100.0	N	N	N
CHINA SPIRIT	33	100.0	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
CHIQUITA BELGIE	156	100.0	N	N	N
CHIQUITA BOCAS	175	100.0	N	N	N
CHIQUITA DEUTSCHLAND	194	100.0	N	N	N
CHIQUITA FRANCES	167	100.0	N	N	N
CHIQUITA ITALIA	156	100.0	N	N	N
CHIQUITA JEAN	178	100.0	N	N	N
CHIQUITA NEDERLAND	119	100.0	N	N	N
CHIQUITA SCANDINAVIA	179	100.0	N	N	N
CHIQUITA SCHWEIZ	162	100.0	N	N	N
CHOYANG PRIDE	153	100.0	N	N	N
CHRISTIANE	81	98.7	Y	Y	N
CIELO DI FIRENZE	28	100.0	N	N	N
CLEVELAND	34	100.0	N	N	N
CLIFFORD MAERSK	88	95.4	Y	Y	Y
COAST RANGE	33	21.2	N	N	N
COLORADO	28	100.0	N	N	N
COLUMBIA BAY	143	100.0	N	N	N
COLUMBIA STAR	278	83.4	N	N	N
COLUMBINE	196	64.2	Y	Y	Y
COLUMBUS AUSTRALIA	100	100.0	N	N	N
COLUMBUS AMERICA	240	100.0	N	N	N
COLUMBUS CALIFORNIA	201	100.0	N	N	N
COLUMBUS CANADA	140	100.0	N	N	N
COLUMBUS NEW ZEALAND	81	100.0	N	N	N
COLUMBUS QUEENSLAND	141	100.0	N	N	N
COLUMBUS VICTORIA	87	100.0	N	N	N
CONDOLEEZZA RICE	115	60.8	Y	Y	Y
CONTIENTAL WING	111	100.0	N	N	N
CONTSHIP AMERICA	28	100.0	N	N	N
CORNELIS VEROLME	9	100.0	N	N	N
CORNUCOPIA	75	72.0	Y	Y	Y
CORONADO	9	88.8	Y	N	N
CORPUS CHRISTI	12	100.0	N	N	N
CORWITH CRAMER	22	18.1	Y	Y	N
COSMIC MASTER	80	43.7	N	N	N
COURAGEOUS	102	5.8	Y	Y	Y
COURIER	55	100.0	N	N	N
COURTNEY BURTON	284	83.8	Y	Y	Y
COURTNEY L.	195	92.8	Y	Y	Y
CRANE PACIFIC	42	100.0	N	N	N
CRISTINA 1	24	100.0	N	N	N
CRISTOFORO COLOMBO	67	38.8	Y	Y	Y
CROWN PRINCESS	31	96.7	Y	N	N
CSAV RAUTEN	50	50.0	N	N	N
CSAV ROMERAL	3	100.0	N	N	N
CSK UNITY	65	96.9	Y	Y	Y
CSL ATLAS	123	100.0	N	N	N
CSS HUDSON	104	100.0	N	N	N
DAVID Z. NORTON	114	95.6	Y	Y	Y
DEL MONTE TRADER	91	24.1	Y	Y	Y
DEL MONTE PACKER	67	95.5	Y	Y	N
DELAWARE TRADER	148	87.8	Y	Y	Y
DELMONTE PLANTER	97	71.1	Y	Y	Y
DELMONTE TRANSPORTER	103	79.6	Y	Y	Y
DENALI	183	94.5	N	N	N
DEPPE FLORIDA	213	100.0	N	N	N
DG COLUMBIA	278	63.6	Y	Y	Y
DIAMOND STATE	36	38.8	Y	N	N
DIRECT EAGLE	107	56.0	N	N	N
DIRECT FALCON	216	64.8	N	N	N
DIRECT KEA	157	100.0	N	N	N
DIRECT KIWI	193	92.7	N	N	N
DIRECT KOOKABURRA	195	65.1	Y	Y	Y
DOCEBRUMA	76	100.0	N	N	N
DOCK EXPRESS 10	148	100.0	N	N	N
DOCK EXPRESS 20	136	100.0	N	N	N
DOCTOR LYKES	32	12.5	Y	N	N
DOLE COSTA RICA	17	100.0	Y	N	N
DOLPHIN IV	9	100.0	N	N	N
DONAU ORE	16	100.0	N	N	N
DOROTHEA OLDENDORFF	133	84.9	Y	Y	Y
DOUBLE GLORY	120	69.1	Y	Y	Y
DSR BALTIC	86	100.0	N	N	N
DSR EUROPE	8	100.0	N	N	N
DSR PACIFIC	147	100.0	N	N	N
DUNCAN ISLAND	7	100.0	N	N	N
DUSSELDORF EXPRESS	145	100.0	N	N	N
DYVI OCEANIC	20	100.0	N	N	N
E.P. LE QUEBECOIS	405	100.0	N	N	N
EARL W. OGLEBAY	15	53.3	Y	N	N
EASTERN LION	263	100.0	N	N	N
EASTWIND	3	100.0	N	N	N
ECSTASY	20	90.0	Y	Y	N
EDELWIESS	164	79.2	Y	Y	Y
EDGAR B. SPEER	190	88.9	Y	Y	Y
EDWIN H. GOTT	348	89.6	Y	Y	Y
EDYTH L.	92	96.7	Y	Y	Y
ELENORE	62	100.0	Y	Y	N
ELLEN HUDIG	17	100.0	N	N	N
ELLEN KNUDSEN	40	97.5	Y	Y	Y
ELLENSBORG	44	0.0	Y	Y	Y
ELSBORG	196	5.6	Y	Y	Y
ENIF	3	100.0	N	N	N
ENTERPRISE	159	100.0	N	N	N
ERIC G. GIBSON	3	100.0	N	N	N
EUROPEAN SENATOR	4	100.0	N	N	N
EVER GAINING	19	100.0	N	N	N
EVER GALLANT	2	100.0	N	N	N
EVER GARLAND	15	66.6	N	N	N
EVER GATHER	10	100.0	N	N	N
EVER GENIUS	10	100.0	N	N	N
EVER GENTLE	1	100.0	N	N	N
EVER GENTRY	45	84.4	Y	Y	N
EVER GIVEN	33	100.0	N	N	N
EVER GLAMOUR	22	100.0	N	N	N
EVER GLEAMY	28	57.1	Y	N	N
EVER GLEEFUL	1	100.0	N	N	N
EVER GLOBE	30	100.0	N	N	N
EVER GLORY	7	85.7	N	N	N
EVER GOING	33	42.4	Y	N	N
EVER GOLDEN	20	100.0	N	N	N
EVER GOVERN	7	100.0	N	N	N
EVER GRADE	17	94.1	N	N	N
EVER GROWTH	17	47.0	Y	Y	N
EVER GUARD	14	78.5	N	N	N
EVER LAUREL	23	100.0	N	N	N
EVER LINKING	19	100.0	N	N	N
EVER RACER	15	86.6	Y	N	N
EVER REFINE	7	100.0	N	N	N
EVER RENOWN	12	100.0	N	N	N
EVER RESULT	70	84.2	Y	N	N
EVER REWARD	17	100.0	N	N	N
EVER ROUND	20	100.0	N	N	N
EWA	197	68.5	Y	Y	Y
EXCELSIOR	253	98.8	N	N	N
EXPORT FREEDOM	80	51.2	Y	Y	Y
EXPORT PATRIOT	155	35.4	Y	Y	Y
FAIRLIFT	6	100.0	N	N	N
FALSTRIA	128	100.0	N	N	N
FANTASY	7	85.7	N	N	N
FARALLON ISLAND	301	100.0	N	N	N
FASCINATION	69	79.7	Y	Y	Y
FAUST	157	46.4	Y	Y	Y
FERNCROFT	170	62.3	N	N	N
FETISH	57	100.0	N	N	N
FIDELIO	77	88.3	Y	N	N
FIR GROVE	40	100.0	N	N	N
FLAMENGO	21	0.0	N	N	N
FLORAL LAKE	129	27.9	Y	Y	Y
FMG CARIBE	39	2.5	N	N	N
FOREST HAWK	28	53.5	N	N	N
FRANCES HAMMER	77	100.0	N	N	N
FRANCES L.	106	93.3	Y	Y	Y
FRED R. WHITE JR	86	66.2	Y	Y	Y
FREJA SVEA	9	100.0	N	N	N
FRINES	23	100.0	N	N	N
GALVESTON BAY	192	90.1	Y	N	N
GEORGE A. STINSON	148	70.9	Y	Y	Y

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
GEORGE A. SLOAN	80	81.2	Y	Y	Y
GEORGE H. WEYERHAEUSER	75	94.6	Y	N	N
GEORGE SCHULTZ	130	71.5	Y	Y	Y
GEORGE WASHINGTON BRID	205	87.8	Y	Y	Y
GEORGIA RAINBOW II	131	100.0	N	N	N
GINGA MARU	103	100.0	N	N	N
GLOBAL LINK	68	76.4	Y	Y	N
GLORIOUS SUN	130	92.3	Y	Y	Y
GREAT LAKE	60	70.0	Y	Y	Y
GREAT LAND	133	84.9	Y	Y	N
GREEN BAY	124	85.4	Y	N	N
GREEN HARBOUR	14	21.4	Y	N	N
GREEN ISLAND	99	50.5	Y	Y	Y
GREEN LAKE	180	28.8	Y	Y	Y
GREEN MAYA	40	100.0	N	N	N
GREEN RAINIER	56	16.0	Y	Y	Y
GREEN RIDGE	170	65.8	Y	Y	Y
GREEN SASEBO	38	65.7	Y	Y	Y
GREEN SUMA	200	11.5	Y	Y	Y
GREEN WAVE	51	33.3	Y	Y	Y
GROWTH RING	157	100.0	N	N	N
GUANAJUATO	26	100.0	N	N	N
GUAYAMA	106	51.8	Y	Y	Y
GULF CURRENT	164	100.0	N	N	N
GULF SPIRIT	26	100.0	N	N	N
GYPSUM BARON	139	100.0	N	N	N
GYPSUM KING	116	100.0	N	N	N
H. LEE WHITE	56	23.2	Y	Y	Y
HAKONE MARU	16	100.0	N	N	N
HAKUFU	69	100.0	N	N	N
HANDY LOGGER	170	66.4	Y	Y	Y
HANJIN BARCELONA	23	100.0	N	N	N
HANJIN CHUNGMU	57	100.0	N	N	N
HANJIN COLOMBO	26	100.0	N	N	N
HANJIN ELIZABETH	17	100.0	N	N	N
HANJIN FELIXSTOWE	13	100.0	N	N	N
HANJIN KAOHSIUNG	17	100.0	N	N	N
HANJIN KEELUNG	12	100.0	N	N	N
HANJIN KOBE	37	100.0	Y	Y	N
HANJIN LE HAVRE	16	100.0	N	N	N
HANJIN LONG BEACH	9	100.0	N	N	N
HANJIN MARSEILLES	36	100.0	N	N	N
HANJIN NEW YORK	57	100.0	N	N	N
HANJIN OAKLAND	15	100.0	N	N	N
HANJIN ROTTERDAM	13	92.3	N	N	N
HANJIN SAVANNAH	20	100.0	N	N	N
HANJIN SEATTLE	35	68.5	Y	Y	N
HANJIN SHANGHAI	31	100.0	N	N	N
HANJIN SINGAPORE	3	100.0	N	N	N
HANJIN TOKYO	14	100.0	N	N	N
HANJIN TONGHAE	47	100.0	N	N	N
HANJIN VANCOUVER	12	100.0	N	N	N
HANJIN YOKOHAMA	32	100.0	N	N	N
HARBOUR BRIDGE	170	61.1	Y	Y	Y
HARMONY ACE	31	100.0	N	N	N
HAVELLAND	110	40.0	Y	Y	Y
HEIDELBERG EXPRESS	676	100.0	N	N	N
HENRY HUDSON BRIDGE	206	100.0	Y	Y	N
HERBERT C. JACKSON	82	57.3	Y	Y	N
HERMOD	108	100.0	N	N	N
HESIOD	41	100.0	N	N	N
HOEGH CAIRN	22	63.6	N	N	N
HOEGH CLIPPER	57	40.3	Y	Y	Y
HOEGH DRAKE	84	42.8	Y	Y	N
HOEGH DUKE	13	100.0	N	N	N
HOEGH DYKE	11	100.0	N	N	N
HOEGH MINERVA	123	29.2	N	N	N
HORIZON	163	10.4	Y	Y	Y
HOWELL LYKES	85	54.1	Y	Y	Y
HUAL ROLITA	23	100.0	N	N	N
HUMACAO	170	37.6	Y	Y	Y
HYUNDAI ADMIRAL	28	100.0	N	N	N
HYUNDAI DUKE	27	96.2	Y	N	N
HYUNDAI EMPEROR	29	100.0	N	N	N
HYUNDAI LONGVIEW	181	71.8	Y	Y	Y
HYUNDAI TACOMA	173	84.3	Y	Y	Y
HYUNDAI VANCOUVER	19	100.0	N	N	N
IGARKA	1	100.0	N	N	N
IMAGINATION	118	83.0	Y	Y	Y
INDIAN OCEAN	53	69.8	Y	Y	Y
INDIANA HARBOR	202	47.0	Y	Y	Y
INGER-C	80	95.0	N	N	N
IOWA TRADER	43	100.0	N	N	N
ISLA GRAN MALVINA	19	100.0	N	N	N
ISLAND BREEZE	102	0.0	Y	Y	Y
ISLAND PRINCESS	45	100.0	N	N	N
ITB BALTIMORE	54	79.6	Y	Y	Y
ITB GROTON	125	91.2	Y	Y	Y
ITB MOBILE	196	96.4	Y	Y	Y
ITB NEW YORK	91	0.0	Y	Y	Y
ITB PHILADELPHIA	114	0.0	N	N	N
IWANUMA MARU	203	24.1	Y	Y	Y
J. DENNIS BONNEY	107	0.0	Y	Y	Y
JACKSONVILLE	86	96.5	N	N	N
JADE PACIFIC	21	100.0	N	N	N
JAHRE SPIRIT	5	100.0	N	N	N
JALAGOVIND	36	100.0	N	N	N
JAMES LYKES	37	100.0	N	N	N
JAMES N. SULLIVAN	2	0.0	Y	N	N
JAMES R. BARKER	124	81.4	Y	Y	N
JAPAN RAINBOW 2	76	100.0	N	N	N
JAPAN SENATOR	63	100.0	N	N	N
JASMINE	69	100.0	N	N	N
JEAN LYKES	48	64.5	Y	N	N
JEBEL ALI	109	73.3	Y	N	N
JO CLIPPER	45	100.0	N	N	N
JO ELM	74	100.0	N	N	N
JOHN G. MUNSON	183	94.5	Y	Y	Y
JOHN J. BOLAND	171	40.3	Y	Y	Y
JOHN PURVES	127	85.8	Y	Y	N
JOSEPH H. FRANTZ	168	79.7	Y	Y	N
JOSEPH L. BLOCK	69	72.4	Y	Y	Y
JUBILANT	10	100.0	N	N	N
JULIUS HAMMER	65	100.0	N	N	N
KAHO	20	0.0	N	N	N
KAIJIN	112	91.9	N	N	N
KAKUSHIMA	72	100.0	N	N	N
KANSAS TRADER	66	100.0	N	N	N
KAPITAN BYANKIN	223	91.0	Y	Y	Y
KAPITAN GNEZPILOV	88	100.0	N	N	N
KAPITAN KONEV	195	87.1	Y	Y	Y
KAPITAN MAN	14	100.0	N	N	N
KAPITAN SERYKH	204	100.0	Y	N	N
KAREN ANDRIE	13	100.0	N	N	N
KAUAI	196	47.4	Y	Y	Y
KAYE E. BARKER	138	55.0	Y	Y	Y
KAZIMAH	135	100.0	N	N	N
KEE LUNG	17	100.0	N	N	N
KENAI	75	100.0	N	N	N
KENNETH E. HILL	81	100.0	N	N	N
KENNETH T. DERR	113	87.6	Y	Y	Y
KENTUCKY HIGHWAY	5	100.0	N	N	N
KEYSTONE CANYON	1	100.0	N	N	N
KINSMAN ENTERPRISE	8	37.5	Y	N	N
KINSMAN INDEPENDENT	170	65.8	Y	Y	Y
KOELN EXPRESS	468	100.0	N	N	N
KOMSOMOLETS PRIMORYA	14	100.0	N	N	N
KONSTANTINOS A	72	100.0	N	N	N
KOPER EXPRESS	45	100.0	N	N	N
KOWLOON BAY	141	100.0	N	N	N
KURAMA	104	100.0	N	N	N
KURE	56	57.1	Y	Y	Y
LA TRINITY	48	62.5	Y	Y	Y
LADY MARYLAND	6	0.0	Y	N	N
LAKE GUARDIAN	73	83.5	N	N	N
LAWRENCE H. GIANELLA	28	100.0	N	N	N
LEON	4	100.0	N	N	N
LEONARD J. COWLEY	29	100.0	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
LEONIA	207	100.0	N	N	N
LERMA	61	100.0	N	N	N
LIBERTY SUN	117	29.0	Y	Y	Y
LIBERTY VICTORY	4	25.0	Y	N	N
LIHUE	129	20.1	Y	Y	Y
LIRCAY	169	58.5	N	N	N
LNG AQUARIUS	132	49.2	Y	Y	Y
LNG CAPRICORN	19	84.2	Y	Y	Y
LNG LEO	40	62.5	N	N	N
LNG TAURUS	43	51.1	Y	Y	Y
LNG VIRGO	60	61.6	Y	Y	Y
LONDON ENTERPRISE	52	100.0	N	N	N
LONDON SPIRIT	74	100.0	N	N	N
LONG BEACH	156	30.1	Y	Y	Y
LONG LINES	18	100.0	N	N	N
LOUISIANA	17	100.0	N	N	N
LT ARGOSY	91	45.0	Y	Y	N
LT PRAGATI	27	100.0	N	N	N
LT. ODYSSEY	18	94.4	Y	N	N
LUCKY	25	100.0	N	N	N
LUCKY GRACE	77	0.0	N	N	N
LUNA MAERSK	205	84.3	Y	Y	Y
LURLINE	168	47.6	Y	Y	Y
MACKINAC BRIDGE	168	98.8	Y	Y	Y
MADISON MAERSK	107	73.8	Y	Y	Y
MAERSK CONSTELLATION	27	100.0	N	N	N
MAERSK LA PLATA	103	100.0	N	N	N
MAERSK LIMA	137	88.3	Y	Y	N
MAERSK SANTOS	31	100.0	N	N	N
MAERSK SUN	107	100.0	N	N	N
MAERSK VANCOUVER	84	1.1	Y	Y	Y
MAERSK YOKOHAMA	51	100.0	N	N	N
MAGIC	48	100.0	N	N	N
MAGLEBY MAERSK	93	26.8	Y	Y	Y
MAHIMAMI	213	68.5	Y	Y	Y
MAJ STEPHEN W PLESS MP	50	64.0	Y	Y	Y
MAJESTIC MAERSK	53	64.1	Y	Y	Y
MANGAL DESAI	159	45.9	Y	Y	Y
MANUKAI	166	36.1	Y	Y	Y
MARCHEN MAERSK	84	78.5	Y	Y	Y
MAREN MAERSK	61	13.1	Y	Y	Y
MARGRETHE MAERSK	30	100.0	N	N	N
MARIA LAURA	184	91.8	Y	Y	Y
MARIA TOPIC	56	64.2	N	N	N
MARIE MAERSK	99	45.4	Y	Y	Y
MARINE RELIANCE	2	100.0	N	N	N
MARIT MAERSK	110	67.2	Y	Y	Y
MARITIME TRAINING CENT	1	100.0	N	N	N
MARK HANNAH	40	65.0	N	N	N
MARLIN	187	0.0	Y	Y	Y
MARTHA II	99	100.0	N	N	N
MATHILDE MAERSK	88	55.6	Y	Y	Y
MATSONIA	193	57.5	Y	Y	Y
MAUI	234	67.9	Y	Y	Y
MAURICE EWING	67	100.0	N	N	N
MAYAGUEZ	111	52.2	N	N	N
MAYVIEW MAERSK	107	60.7	Y	Y	Y
MC-KINNEY MAERSK	112	64.2	Y	Y	Y
MEARSK NEWARK	25	76.0	Y	N	N
MEDALLION	110	100.0	N	N	N
MEDUSA CHALLENGER	396	70.2	Y	Y	Y
MELBOURNE STAR	84	100.0	N	N	N
MELVILLE	277	43.3	N	N	N
MERCHANT PRINCE	104	100.0	N	N	N
MERCHANT PREMIER	162	100.0	N	N	N
MERCHANT PRINCIPAL	67	100.0	N	N	N
MERCURY DIAMOND	70	100.0	N	N	N
MERIDA	161	100.0	N	N	N
MERIDIAN	60	0.0	Y	Y	Y
MERLION ACE	47	95.7	Y	Y	Y
MESABI MINER	178	81.4	Y	Y	Y
METTE MAERSK	100	36.0	Y	Y	Y
MICHELLE	26	100.0	N	N	N
MICHIGAN	298	33.2	Y	Y	Y

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
MIDDLETOWN	107	40.1	Y	Y	Y
MILDBURG	41	100.0	N	N	N
MINERAL OSPREY	100	96.0	Y	Y	Y
MING PEACE	71	100.0	N	N	N
MING PLEASURE	126	100.0	N	N	N
MING PROPITIOUS	7	100.0	N	N	N
MITLA	91	100.0	N	N	N
MOANA PACIFIC	116	68.1	Y	Y	Y
MOANA WAVE	44	100.0	N	N	N
MOKIHANA	210	70.9	Y	Y	Y
MOKU PAHU	15	100.0	N	N	N
MONOA	194	15.4	Y	Y	Y
MONTERREY	229	89.9	Y	Y	Y
MORELOS	254	67.3	Y	Y	Y
MORMACSKY	11	100.0	N	N	N
MORMACSTAR	3	100.0	N	N	N
MORMACSUN	54	81.4	Y	Y	Y
MOSEL ORE	223	100.0	N	N	N
MSC MAUREEN	89	88.7	Y	Y	Y
MT. CABRITE	146	100.0	N	N	N
MYRON C. TAYLOR	131	91.6	N	N	N
NARA	35	100.0	N	N	N
NATIONAL DIGNITY	34	76.4	Y	Y	Y
NATIONAL HONOR	41	70.7	Y	Y	Y
NATIONAL PRIDE	106	27.3	Y	Y	Y
NEDLLOYD DELFT	25	100.0	N	N	N
NEDLLOYD HOLLAND	137	74.4	Y	Y	N
NEDLLOYD MAAS	29	100.0	N	N	N
NEDLLOYD RALEIGH BAY	8	100.0	N	N	N
NEDLLOYD ROTTERDAM	108	100.0	N	N	N
NEDLLOYD TOKYO	1	100.0	N	N	N
NEDLLOYD VAN CLOON	48	100.0	N	N	N
NEDLLOYD VAN DIEMEN	140	100.0	N	N	N
NEDLLOYD VAN NECK	37	100.0	N	N	N
NEDLLOYD VAN NOORT	72	100.0	N	N	N
NEGO LOMBOK	20	100.0	N	N	N
NEPTUNE ACE	142	100.0	N	N	N
NEPTUNE AKABAR	10	100.0	N	N	N
NEPTUNE AMBER	14	100.0	N	N	N
NEPTUNE CORAL	16	100.0	N	N	N
NEPTUNE CRYSTAL	12	100.0	N	N	N
NEPTUNE DIAMOND	37	37.8	Y	N	N
NEPTUNE GARNET	26	100.0	N	N	N
NEPTUNE JADE	56	100.0	N	N	N
NEPTUNE PEARL	12	100.0	N	N	N
NEW CARISSA	29	100.0	N	N	N
NEW HORIZON	13	53.8	N	N	N
NEW NIKKI	204	98.0	Y	Y	Y
NEW YORK SUN	59	71.1	Y	Y	Y
NEWARK BAY	120	94.1	Y	Y	Y
NEWPORT BRIDGE	57	100.0	N	N	N
NIEUW AMSTERDAM	102	100.0	N	N	N
NOAA DAVID STARR JORDA	72	54.1	Y	Y	N
NOAA SHIP MILLER FREEM	218	92.6	Y	Y	N
NOAA SHIP FERREL	185	92.9	Y	N	N
NOAA SHIP DISCOVERER O	423	86.7	Y	Y	Y
NOAA SHIP MCARTHUR	440	85.2	Y	Y	Y
NOAA SHIP T. CROMWELL	195	100.0	N	N	N
NOAA SHIP RAINIER	86	80.2	Y	N	N
NOAA SHIP ALBATROSS IV	103	90.2	Y	Y	N
NOAA SHIP OREGON II	347	69.7	Y	Y	Y
NOAA SHIP CHAPMAN	1	100.0	N	N	N
NOAA SHIP M. BALDRIDGE	519	77.4	Y	Y	Y
NOBEL STAR	61	100.0	N	N	N
NOL CANOPUS	21	100.0	N	N	N
NOL RUBY	36	100.0	N	N	N
NOL TOPAZ	35	100.0	N	N	N
NOMZI	328	73.1	Y	Y	Y
NORD JAHRE TRANSPORTER	231	100.0	N	N	N
NORD JAHRE TARGET	31	100.0	N	N	N
NORTHERN LION	144	100.0	N	N	N
NORTHERN LIGHTS	12	100.0	N	N	N
NORWAY	212	62.2	Y	Y	Y
NOSAC CEDAR	145	100.0	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
NOSAC EXPLORER	3	100.0	N	N	N
NOSAC RANGER	87	100.0	N	N	N
NOSAC TAI SHAN	1	100.0	N	N	N
NOSAC TAKAYAMA	192	65.6	Y	Y	Y
NUERNBERG EXPRESS	246	100.0	N	N	N
NUEVO LEON	68	98.5	Y	N	N
NUEVO SAN JUAN	43	55.8	Y	Y	N
NURNBERG EXPRESS	608	100.0	N	N	N
NYK SEABREEZE	96	100.0	N	N	N
NYK SPRINGTIDE	144	100.0	N	N	N
NYK STARLIGHT	106	100.0	N	N	N
NYK SUNRISE	86	100.0	N	N	N
NYK SURFWIND	49	100.0	N	N	N
OAXACA	211	96.6	N	N	N
OBO ELIF	31	3.2	Y	Y	Y
OCEAN LAUREL	74	39.1	Y	Y	Y
OCEAN ORCHID	38	97.3	Y	Y	Y
OCEAN SPIRIT	101	100.0	N	N	N
OCEANBREEZE	114	89.4	Y	Y	Y
OCEANUS OSAKA	23	21.7	Y	N	N
ODELIA	196	25.5	Y	Y	Y
OLEANDER	147	85.0	Y	Y	Y
OLIVEBANK	151	100.0	N	N	N
OMI COLUMBIA	8	100.0	N	N	N
OOCL AMERICA	26	80.7	N	N	N
OOCL BRAVERY	108	100.0	N	N	N
OOCL CALIFORNIA	49	100.0	N	N	N
OOCL EDUCATOR	56	100.0	N	N	N
OOCL ENVOY	108	100.0	N	N	N
OOCL EXPLORER	24	100.0	N	N	N
OOCL FAIR	121	97.5	Y	Y	Y
OOCL FAITH	40	100.0	N	N	N
OOCL FIDELITY	79	97.4	Y	Y	Y
OOCL FORTUNE	96	100.0	N	N	N
OOCL FREEDOM	259	100.0	N	N	N
OOCL FRIENDSHIP	52	100.0	N	N	N
OOCL INNOVATION	76	100.0	N	N	N
OOCL INSPIRATION	102	100.0	N	N	N
ORANGE BLOSSOM	47	61.7	Y	N	N
OREGON RAINBOW III	112	53.5	Y	Y	N
ORIENTE PRIME	29	68.9	Y	Y	N
ORION HIGHWAY	127	76.3	Y	Y	N
OSAKA BAY	156	100.0	N	N	N
OURO DO BRASIL	41	100.0	N	N	N
OVERSEAS ARCTIC	64	71.8	N	N	N
OVERSEAS ALASKA	35	60.0	Y	N	N
OVERSEAS CHICAGO	34	100.0	N	N	N
OVERSEAS HARRIET	62	100.0	N	N	N
OVERSEAS JUNEAU	67	0.0	N	N	N
OVERSEAS JOYCE	115	100.0	N	N	N
OVERSEAS MARILYN	6	100.0	N	N	N
OVERSEAS NEW ORLEANS	62	100.0	N	N	N
OVERSEAS OHIO	23	65.2	N	N	N
OVERSEAS WASHINGTON	12	100.0	N	N	N
PACASIA	101	100.0	N	N	N
PACDUKE	73	100.0	N	N	N
PACIFIC ARIES	68	100.0	N	N	N
PACIFIC PRINCESS	109	100.0	N	N	N
PACMERCHANT	18	100.0	N	N	N
PACPRINCE	23	100.0	N	N	N
PACPRINCESS	21	100.0	N	N	N
PACSEA	21	100.0	N	N	N
PACSUN	24	100.0	N	N	N
PADRONE	115	100.0	N	N	N
PALMGRACHT	92	100.0	N	N	N
PATRIOT	34	76.4	Y	Y	N
PAUL BUCK	21	100.0	N	N	N
PAUL H. TOWNSEND	136	79.4	Y	Y	N
PAUL R. TREGURTHA	349	91.9	Y	Y	Y
PEARL ACE	15	100.0	N	N	N
PEGGY DOW	5	100.0	N	N	N
PETER W. ANDERSON	4	100.0	N	N	N
PFC DEWAYNE T. WILLIAM	7	100.0	N	N	N
PFC EUGENE A. OBREGON	35	37.1	Y	N	N
PFC JAMES ANDERSON JR	119	38.6	Y	N	N
PHAROS	83	100.0	N	N	N
PHILIP R. CLARKE	115	84.3	Y	Y	Y
PIERRE FORTIN	75	100.0	N	N	N
PIONEER SERVICE	7	0.0	N	N	N
PISCES EXPLORER	71	100.0	N	N	N
PISCES PIONEER	120	100.0	N	N	N
PISCES PLANTER	64	100.0	N	N	N
PLATTE	15	100.0	N	N	N
POLAR EAGLE	134	49.2	N	N	N
POLYNESIA	81	98.7	Y	N	N
POOLGRACHT	105	100.0	N	N	N
POROS	18	100.0	Y	Y	Y
PORT STAR	58	100.0	N	N	N
POTOMAC TRADER	7	100.0	N	N	N
POYANG	237	100.0	N	N	N
POYARKOVO	40	100.0	N	N	N
PRESIDENT F. ROOSEVELT	201	33.8	Y	Y	Y
PRESIDENT EISENHOWER	171	87.7	Y	Y	Y
PRESIDENT GRANT	73	87.6	Y	Y	N
PRESIDENT HARRISON	102	100.0	N	N	N
PRESIDENT TRUMAN	63	84.1	Y	N	N
PRESIDENT GARFIELD	32	75.0	Y	Y	Y
PRESIDENT BUCHANAN	80	26.2	Y	Y	Y
PRESIDENT HARDING	56	66.0	Y	Y	Y
PRESIDENT KENNEDY	180	82.2	Y	Y	Y
PRESIDENT JACKSON	72	0.0	Y	Y	Y
PRESIDENT POLK	195	72.8	Y	Y	N
PRESIDENT ARTHUR	29	100.0	N	N	N
PRESIDENT ADAMS	214	64.0	Y	Y	Y
PRESQUE ISLE	134	73.1	Y	Y	N
PRIDE OF BALTIMORE II	29	48.2	Y	Y	N
PRINCE OF TOKYO	193	53.3	N	N	N
PRINCE OF OCEAN	221	25.7	Y	Y	Y
PRINCE WILLIAM SOUND	100	65.0	Y	Y	Y
PROJECT ORIENT	125	100.0	N	N	N
PUERTO CORTES	34	100.0	N	N	N
PVT FRANKLIN J. PHILLI	68	51.4	Y	N	N
PYTCHLEY	257	100.0	N	N	N
QUALITY OF LIFE	4	100.0	N	N	N
QUEEN ELIZABETH 2	134	100.0	N	N	N
QUEENSLAND STAR	183	100.0	N	N	N
R. HAL DEAN	26	100.0	N	N	N
R.J. PFEIFFER	154	48.7	Y	Y	Y
RANI PADMINI	8	100.0	N	N	N
REGAL EMPRESS	15	93.3	Y	N	N
REGAL PRINCESS	80	96.2	Y	Y	N
REGINA J	44	100.0	N	N	N
REPULSE BAY	133	100.0	N	N	N
RESERVE	156	67.9	Y	Y	Y
RESOLUTE	151	52.9	Y	Y	Y
RHINE FOREST	191	56.5	Y	Y	Y
RICHARD G MATTIESEN	43	100.0	N	N	N
RICHARD REISS	44	95.4	Y	Y	Y
RICHMOND BAY	114	100.0	N	N	N
ROBERT E. LEE	90	40.0	Y	Y	Y
ROGER BLOUGH	214	88.7	Y	Y	Y
ROSINA TOPIC	145	36.5	Y	Y	Y
ROSITA	53	81.1	Y	Y	Y
ROTTERDAM	83	100.0	N	N	N
ROVER	10	100.0	N	N	N
ROYAL MAJESTY	121	0.0	Y	Y	Y
ROYAL PRINCESS	65	100.0	N	N	N
RUBIN KOBE	166	100.0	N	N	N
RUBIN STAR	66	66.6	Y	N	N
RUBIN STELLA	143	34.2	Y	Y	Y
RYNDAM	38	100.0	N	N	N
S.T. CRAPO	106	78.3	Y	Y	Y
S/S WILSON	52	59.6	Y	N	N
SALINAS	18	100.0	N	N	N
SAM HOUSTON	65	55.3	Y	N	N
SAMUEL GINN	75	12.0	Y	Y	Y
SAMUEL H. ARMACOST	66	59.0	Y	Y	Y
SAMUEL L. COBB	11	100.0	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
SAMUEL RISLEY	570	100.0	N	N	N
SAN ISIDRO	147	100.0	N	N	N
SAN MARCOS	136	71.3	Y	Y	Y
SAN VINCENTE	47	100.0	N	N	N
SANKO LAUREL	4	100.0	N	N	N
SANKO MOON	22	100.0	N	N	N
SANKO POPPY	154	55.8	Y	Y	Y
SANKO SOUTH	41	100.0	N	N	N
SANKO SPLENDOUR	37	100.0	N	N	N
SANKO SPRUCE	78	42.3	Y	N	N
SANTA FE DE BOGOTA	56	100.0	N	N	N
SANTA MONICA	6	100.0	N	N	N
SANTORIN 2	320	23.1	Y	Y	Y
SARAJEVO EXPRESS	3	100.0	N	N	N
SAUDI RIYADH	31	96.7	N	N	N
SAUDI TABUK	91	58.2	Y	Y	N
SAVANNAH	63	100.0	N	N	N
SEA COMMERCE	137	64.9	Y	Y	Y
SEA EXCELLENCE	40	95.0	Y	N	N
SEA FLORIDA	127	91.3	Y	Y	N
SEA FOX	101	26.7	Y	Y	N
SEA ISLE CITY	91	100.0	N	N	N
SEA JUSTICE	17	100.0	N	N	N
SEA LION	214	92.5	Y	Y	Y
SEA MARINER	98	71.4	Y	Y	N
SEA MERCHANT	253	98.8	Y	N	N
SEA NOVIA	51	92.1	Y	N	N
SEA PREMIER	138	100.0	N	N	N
SEA PRINCESS	18	100.0	N	N	N
SEA RACER	5	100.0	N	N	N
SEA SPRAY	9	100.0	N	N	N
SEA TRADE	86	79.0	Y	Y	Y
SEA WOLF	280	88.5	Y	Y	Y
SEABOARD OCEAN	44	54.5	N	N	N
SEABOARD SUN	76	6.5	Y	Y	Y
SEABOARD UNIVERSE	105	86.6	Y	Y	Y
SEABREEZE I	25	100.0	N	N	N
SEALAND ANCHORAGE	138	59.4	Y	Y	Y
SEALAND ATLANTIC	88	51.1	N	N	N
SEALAND CHAMPION	239	88.2	Y	Y	Y
SEALAND CHALLENGER	190	41.5	Y	Y	Y
SEALAND COMET	120	95.8	N	N	N
SEALAND CONSUMER	6	100.0	N	N	N
SEALAND COSTA RICA	37	91.8	Y	Y	Y
SEALAND CRUSADER	104	86.5	Y	Y	Y
SEALAND DEVELOPER	149	53.6	Y	Y	Y
SEALAND DEFENDER	158	67.0	Y	Y	Y
SEALAND DISCOVERY	145	53.1	Y	Y	Y
SEALAND ENDURANCE	79	63.2	Y	Y	Y
SEALAND ENTERPRISE	254	83.8	Y	Y	Y
SEALAND EXPRESS	124	100.0	N	N	N
SEALAND EXPEDITION	37	37.8	Y	Y	N
SEALAND EXPLORER	162	88.8	Y	Y	Y
SEALAND HAWAII	166	83.1	Y	Y	Y
SEALAND INTEGRITY	132	56.0	N	N	N
SEALAND INDEPENDENCE	143	33.5	Y	Y	Y
SEALAND INNOVATOR	90	1.1	Y	Y	Y
SEALAND KODIAK	129	31.0	Y	Y	N
SEALAND LIBERATOR	123	57.7	Y	Y	Y
SEALAND NAVIGATOR	143	72.0	Y	N	N
SEALAND PATRIOT	47	100.0	N	N	N
SEALAND PACIFIC	164	90.8	Y	Y	Y
SEALAND PERFORMANCE	143	77.6	Y	Y	Y
SEALAND PRODUCER	185	75.1	Y	Y	Y
SEALAND QUALITY	90	54.4	Y	Y	Y
SEALAND RELIANCE	215	52.0	Y	Y	Y
SEALAND SPIRIT	216	46.7	Y	Y	Y
SEALAND TACOMA	59	100.0	N	N	N
SEALAND TRADER	208	84.6	Y	Y	Y
SEALAND VOYAGER	30	46.6	N	N	N
SEARIVER BENICIA	41	60.9	Y	Y	Y
SEARIVER BATON ROUGE	20	75.0	Y	Y	Y
SEARIVER CHARLESTOWN	6	100.0	Y	N	N
SEARIVER LONG BEACH	21	38.0	Y	N	N
SEARIVER PHILADELPHIA	7	85.7	N	N	N
SEARIVER SAN FRANCISCO	26	100.0	Y	Y	Y
SEAWARD JOHNSON	195	1.5	Y	Y	Y
SEDCO/BP 471	140	100.0	N	N	N
SENATOR	154	100.0	N	N	N
SENORITA	180	5.0	Y	Y	Y
SENSATION	173	64.1	Y	Y	Y
SERENITY	96	75.0	Y	N	N
SETO BRIDGE	157	100.0	N	N	N
SEVEN OCEAN	41	97.5	Y	Y	Y
SGT WILLIAM A BUTTON	18	100.0	N	N	N
SGT. METEJ KOCAK	19	36.8	N	N	N
SHELDON LYKES	66	100.0	N	N	N
SHELLY BAY	63	87.3	Y	Y	Y
SHIRAOI MARU	179	81.5	Y	Y	Y
SIBOHELLE	133	100.0	N	N	N
SIDNEY STAR	173	100.0	N	N	N
SIERRA MADRE	24	100.0	N	N	N
SINCERE GEMINI	72	83.3	Y	Y	Y
SKAUBRYN	151	100.0	N	N	N
SKAUGRAN	162	100.0	N	N	N
SKOGAFOSS	176	100.0	N	N	N
SOL DO BRASIL	120	100.0	N	N	N
SOLANO	21	100.0	N	N	N
SONORA	62	100.0	N	N	N
SOREN TOUBRO	77	100.0	N	N	N
SOUTHERN LION	167	100.0	N	N	N
SOUTHERN PRINCESS	195	0.0	Y	Y	Y
SOVEREIGN OF THE SEAS	86	79.0	Y	Y	Y
SPRING BEAR	188	100.0	N	N	N
SPRING GANNET	24	100.0	N	N	N
ST. LUCIA	35	100.0	N	N	N
STAFFORDSHIRE	182	100.0	N	N	N
STAR ALABAMA	41	100.0	N	N	N
STAR AMERICA	75	70.6	Y	N	N
STAR DAVANGER	42	100.0	N	N	N
STAR DROTTANGER	8	100.0	N	N	N
STAR EAGLE	20	100.0	N	N	N
STAR EVVIVA	57	100.0	N	N	N
STAR FLORIDA	25	100.0	N	N	N
STAR FRASER	90	100.0	N	N	N
STAR FUJI	40	100.0	N	N	N
STAR GRAN	20	100.0	N	N	N
STAR OF MARIA	3	100.0	N	N	N
STAR SIRANGER	2	100.0	N	N	N
STAR SKARVEN	110	43.6	Y	Y	Y
STAR STRONEN	66	100.0	N	N	N
STATE OF GUIARAT	10	100.0	N	N	N
STELLA	123	85.3	Y	Y	Y
STEPAN KRASHENINNIKOV	38	100.0	N	N	N
STEWART J. CORT	389	86.8	Y	Y	Y
STOLT AVENIR	12	100.0	N	N	N
STOLT CONDOR	3	100.0	N	N	N
STOLT RESOLUTE	58	100.0	N	N	N
STONEWALL JACKSON	106	49.0	Y	Y	N
STRONG CAJUN	83	96.3	N	N	N
STRONG VIRGINIAN	40	100.0	N	N	N
SUGAR ISLANDER	40	100.0	N	N	N
SUN VIKING	5	100.0	N	N	N
SUNBELT DIXIE	29	86.2	Y	Y	Y
SUNDA	52	100.0	N	N	N
SVEN OLTMANN	202	95.5	Y	Y	Y
TAI HE	145	100.0	N	N	N
TAI SHING	33	100.0	N	N	N
TALLAHASSEE BAY	45	100.0	N	N	N
TAMPA BAY	44	100.0	N	N	N
TEPOZTECO II	151	100.0	N	N	N
TEQUI	88	62.5	Y	N	N
THOMAS G. THOMPSON	151	63.5	Y	Y	Y
THOMPSON LYKES	25	48.0	Y	N	N
THOMPSON PASS	17	11.7	Y	N	N
TILLIE LYKES	42	100.0	N	N	N
TOHZAN	13	100.0	N	N	N
TOKIO EXPRESS	110	100.0	N	N	N

NAME	TOTAL OBS	PERCENT VIA RADIO	MANUSCRIPT RECEIVED OCT	NOV	DEC
TOLUCA	193	69.4	Y	Y	Y
TONSINA	33	72.7	Y	N	N
TORBEN	256	46.4	Y	Y	Y
TORM FREYA	79	100.0	N	N	N
TOWER BRIDGE	41	100.0	N	N	N
TRANSWORLD BRIDGE	158	88.6	Y	Y	Y
TRIGGER	40	100.0	N	N	N
TRITON	226	73.4	Y	Y	Y
TROPIC DAY	29	55.1	Y	Y	Y
TROPIC FLYER	73	24.6	Y	Y	Y
TROPIC ISLE	16	0.0	N	N	N
TROPIC JADE	69	49.2	Y	Y	Y
TROPIC KEY	35	2.8	Y	Y	N
TROPIC LURE	51	54.9	Y	Y	Y
TROPIC MIST	46	0.0	Y	Y	Y
TROPIC NIGHT	79	0.0	Y	Y	Y
TROPIC PALM	43	0.0	Y	Y	Y
TROPIC SUN	143	39.1	Y	Y	Y
TROPIC TIDE	118	88.1	Y	Y	Y
TRSL ARCTURUS	30	100.0	N	N	N
TRUST 38	17	100.0	N	N	N
TSL BOLD	57	100.0	N	N	N
TULSIDAS	18	100.0	N	N	N
TYSON LYKES	93	33.3	Y	Y	Y
ULLSWATER	195	100.0	N	N	N
ULTRASEA	1	100.0	N	N	N
UNIVERSE	23	100.0	N	N	N
USCGC ACACIA (WLB406)	22	100.0	N	N	N
USCGC ACTIVE WMEC 618	81	33.3	N	N	N
USCGC ACUSHNET WMEC 16	88	100.0	N	N	N
USCGC ALERT (WMEC 630)	53	52.8	Y	N	N
USCGC BASSWOOD (WLB 38	18	100.0	N	N	N
USCGC BEAR (WEMC 901)	21	85.7	Y	N	N
USCGC BOUTWELL WHEC 71	100	57.0	Y	Y	N
USCGC BRAMBLE (WLB 392	3	100.0	N	N	N
USCGC CAMPBELL	51	58.8	Y	Y	N
USCGC CHASE (WHEC 718)	8	100.0	N	N	N
USCGC CONFIDENCE WMEC6	54	100.0	N	N	N
USCGC COURAGEOUS	24	100.0	N	N	N
USCGC DAUNTLESS WMEC 6	91	98.9	Y	N	N
USCGC DECISIVE WMEC 62	4	100.0	N	N	N
USCGC DILIGENCE WMEC 6	5	100.0	N	N	N
USCGC DURABLE (WMEC 62	78	100.0	N	N	N
USCGC FIREBUSH WLB 393	15	100.0	N	N	N
USCGC FORWARD	42	100.0	N	N	N
USCGC GALLATIN	76	100.0	N	N	N
USCGC HARRIET LANE	25	100.0	N	N	N
USCGC JARVIS (WHEC 725	61	100.0	N	N	N
USCGC LAUREL (WLB 291)	12	0.0	Y	N	N
USCGC LEGARE	36	55.5	Y	Y	Y
USCGC MACKINAW	28	64.2	Y	Y	Y
USCGC MALLOW (WLB 396)	14	100.0	N	N	N
USCGC MELLON (WHEC 717	18	100.0	N	N	N
USCGC MIDGETT (WHEC 72	104	90.3	Y	Y	Y
USCGC MOHAWK WMEC 913	6	66.6	N	N	N
USCGC MORGENTHAU	27	100.0	N	N	N
USCGC MUNRO	29	100.0	N	N	N
USCGC NORTHLAND WMEC 9	102	79.4	Y	Y	Y
USCGC PLANETREE	49	67.3	Y	Y	N
USCGC POLAR STAR (WAGB	199	100.0	N	N	N
USCGC POLAR SEA__(WAGB	6	100.0	N	N	N
USCGC RELIANCE WMEC 61	61	100.0	N	N	N
USCGC RUSH	1	100.0	N	N	N
USCGC SEDGE (WLB 402)	11	100.0	N	N	N
USCGC SENECA	20	100.0	N	N	N
USCGC SPENCER	32	100.0	N	N	N
USCGC STEADFAST (WMEC	6	100.0	N	N	N
USCGC STORIS (WMEC 38)	223	73.9	Y	Y	Y
USCGC SUNDEW (WLB 404)	15	100.0	N	N	N
USCGC SWEETBRIER WLB 4	24	100.0	N	N	N
USCGC TAHOMA	25	100.0	N	N	N
USCGC TAMPA WMEC 902	14	0.0	Y	Y	N
USCGC VALIANT (WMEC 62	64	62.5	Y	Y	N
USCGC VIGILANT WMEC 61	6	100.0	N	N	N
USCGC VIGOROUS WMEC 62	3	66.6	Y	N	N
USCGC WOODRUSH (WLB 40	1	100.0	N	N	N
USCGC YOCONA (WMEC 168	70	90.0	Y	Y	N
USNS ALGOL	22	100.0	N	N	N
USNS ALTAIR	76	7.8	N	N	N
USNS ANTARES	24	0.0	Y	N	N
USNS APACHE (T-ATF 172	12	100.0	N	N	N
USNS BELLATRIX	4	100.0	N	N	N
USNS DENEBOLA	4	0.0	N	N	N
USNS GUADALUPE	36	100.0	N	N	N
USNS GUS W. DARNELL	43	100.0	N	N	N
USNS HAYES	24	58.3	Y	Y	N
USNS HENRY J. KAISER	11	100.0	N	N	N
USNS JOHN LENTHALL	77	0.0	Y	Y	Y
USNS KANAWHA T-AO 196	37	0.0	N	N	N
USNS KANE TAGS 27	110	37.2	N	N	N
USNS MOHAWK (T-ATF 170	40	0.0	Y	N	N
USNS NARRAGANSETT	159	66.6	Y	Y	Y
USNS NAVAJO_(TATF-169)	71	100.0	N	N	N
USNS OBSERVATION ISLAN	65	100.0	N	N	N
USNS PATHFINDER T-AGS	61	52.4	Y	Y	Y
USNS PATUXENT	17	100.0	N	N	N
USNS PECOS	15	100.0	N	N	N
USNS POLLUX	11	100.0	N	N	N
USNS POWHATAN TATF 166	4	100.0	Y	N	N
USNS RAPPAHANNOCK TAO-	17	100.0	N	N	N
USNS SAN DIEGO	76	75.0	Y	Y	N
USNS SATURN T-AFS-10	96	0.0	N	N	N
USNS SILAS BENT T-AGS	20	100.0	N	N	N
USNS SIRIUS (T-AFS 8)	1	100.0	N	N	N
USNS TIPPECANOE (TAO-1	22	100.0	N	N	N
USNS VANGUARD TAG 194	197	69.0	Y	Y	N
USNS WALTER S. DIEHL	16	100.0	N	N	N
USNS YUKON (T-AO 202)	95	87.3	Y	Y	N
USS RUSSELL DDG-59	12	100.0	N	N	N
VARMLAND	49	100.0	N	N	N
VEGA	86	100.0	N	N	N
VENUS DIAMOND	55	100.0	N	N	N
VERA ACORDE	31	48.3	Y	Y	N
VIDAL	106	100.0	N	N	N
VINE	219	100.0	N	N	N
VIRGINIA	304	12.8	Y	Y	Y
VISAYAS VICTORY	40	0.0	Y	Y	Y
VIVA	187	35.8	Y	Y	Y
WALTER J. MCCARTHY	243	79.8	Y	Y	Y
WAVELET	9	100.0	N	N	N
WESTERDAM	17	100.0	N	N	N
WESTERN FRIEND	121	45.4	Y	Y	Y
WESTERN LION	172	100.0	N	N	N
WESTWARD	1	100.0	N	N	N
WESTWARD VENTURE	377	64.9	Y	Y	Y
WESTWOOD ANETTE	192	78.6	Y	Y	Y
WESTWOOD BELINDA	151	56.2	Y	Y	Y
WESTWOOD CLEO	101	100.0	N	N	N
WESTWOOD FUJI	116	58.6	Y	Y	Y
WESTWOOD HALLA	154	65.5	N	N	N
WESTWOOD JAGO	135	95.5	Y	Y	Y
WESTWOOD MARIANNE	144	85.4	Y	Y	Y
WILFRED SYKES	66	62.1	Y	Y	Y
WILLIAM E. CRAIN	1	100.0	N	N	N
WILLIAM E. MUSSMAN	60	55.0	N	N	N
WOLVERINE	30	73.3	N	N	N
YOHFU	30	36.6	Y	N	N
YOHJIN	4	100.0	N	N	N
YOUNG SPROUT	16	43.7	Y	N	N
YUCATAN	95	38.9	Y	Y	Y
YURIY OSTROVSKIY	160	92.5	Y	Y	Y
YUYO BREEZE	101	72.2	Y	Y	Y
ZAGREB EXPRESS	18	100.0	N	N	N
ZENITH	9	100.0	N	N	N
ZETLAND	165	100.0	N	N	N
ZIM AMERICA	66	100.0	N	N	N
ZIM CANADA	48	100.0	N	N	N
ZIM IBERIA	39	100.0	N	N	N
ZIM ISRAEL	81	100.0	N	N	N
ZIM ITALIA	69	89.8	Y	N	N
ZIM JAPAN	61	100.0	N	N	N
ZIM KEELUNG	62	100.0	N	N	N
ZIM KOREA	119	80.6	Y	Y	N
ZIM SAN JUAN	142	30.2	Y	Y	Y
GRAND TOTAL	96341				
TOTAL VIA RADIO	75302				
PERCENT VIA RADIO	78.1				

Buoy Climatological Data Summary

Weather observations are taken each hour during a 20-minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one-third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most tations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0-minute averaging period each hour (moored buoys) and a 2.0-minute averaging period for fixed stations (C-MAN). Contact NDBC Data Systems Division, Bldg. 1100, SSC. Mississippi 39529 or phone (601) 688-1720 for more details.

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SCALAR WAVE HT (DA/HR)	MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KNOTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
December 1995													
41001	34.7N	072.6W	0722	14.1		2.4	5.2	21/03	16.8	NW	31.7	16/23	1016.8
41002	32.4N	075.3W	0741	16.2	21.0				13.7	NW	26.0	20/06	1018.1
41004	32.5N	079.1W	0739	13.8	21.0	1.1	3.2	19/20	12.5	NW	27.4	26/04	1019.9
41006	29.3N	077.3W	0739	20.0	23.5	1.7	4.9	20/17	12.6	NW	30.3	20/16	1017.5
41009	28.5N	080.2W	1486	19.0	22.9	1.2	2.6	10/11	12.6	NW	28.6	20/12	1018.8
41010	28.9N	078.5W	1478	20.2	24.3	1.5	4.7	20/12	12.8	NW	27.0	20/08	1018.2
41018	15.0N	075.0W	0742	27.6	27.9	1.5	3.9	31/14	14.6	E	23.9	31/09	1012.8
41021	31.9N	080.9W	0185	13.4	14.6	0.5	1.6	08/12	7.9	NE	22.0	08/13	1019.8
41022	31.9N	080.9W	0206	14.0	14.9				8.2	NE	22.7	08/13	1019.7
42001	25.9N	089.7W	0733	21.5	24.6				12.1	NE	38.3	22/18	1018.5
42002	25.9N	093.6W	0739	21.1	23.3	1.4	5.3	22/14	14.1	SE	38.3	22/12	1018.1
42003	25.9N	085.9W	0736	22.0	26.9	1.3	4.2	10/21	13.7	E	35.6	22/23	1017.6
42007	30.1N	088.8W	0743	12.5	16.0				12.7	N	32.3	10/00	1020.3
42019	27.9N	095.0W	0743	18.6	22.6	1.3	3.5	09/14	13.7	NE	29.0	18/14	1018.6
42020	27.0N	096.5W	0738	20.0		1.5	4.9	22/09	14.1	S	31.9	22/08	1018.2
42035	29.3N	094.4W	0739	14.2	16.5	0.8	2.0	09/09	11.4	SE	28.0	19/02	1019.1
42036	28.5N	084.5W	0738	17.6	21.3	1.0	4.2	20/04	11.7	E	26.4	20/03	1020.4
42037	24.5N	081.4W	0364	22.8	25.4	0.6	2.1	11/23					1019.3
42039	28.0N	086.0W	0461	16.2	21.9	1.2	4.0	20/02	12.8	NW	26.4	19/21	1019.0
42040	29.2N	088.3W	0649	15.8	21.6	1.2	4.0	10/04	12.8	N	29.0	10/04	1019.2
44004	38.5N	070.7W	0740	8.1	14.1	2.8	7.6	22/06	18.5	NW	36.5	11/08	1014.9
44005	42.9N	069.0W	0737	2.8	7.8	2.0	5.3	20/20	18.4	NW	32.6	02/10	1011.0
44007	43.5N	070.2W	0739	-1.2	6.1	0.9	5.5	10/06	14.2	NW	29.5	01/14	1012.0
44008	40.5N	069.4W	0721		7.9	2.3	6.0	21/17	16.6	NW	33.0	21/15	1013.0
44009	38.5N	074.7W	0737	3.6	8.7	1.2	3.9	20/05	16.8	NW	33.0	20/23	1017.3
44011	41.1N	066.6W	0738	4.7	8.5	2.8	6.8	21/17	18.2	NW	37.1	10/05	1010.8
44013	42.4N	070.7W	0731	0.6	6.9	1.0	5.0	20/13	16.9	NW	31.1	20/14	1012.9
44014	36.6N	074.8W	0729	7.6	12.8				15.7	NW	33.2	16/18	1018.3
44025	40.3N	073.2W	0647	1.7	8.6	1.3	3.6	11/12	17.7	NW	33.2	21/23	1015.9
44028	41.4N	071.1W	0734		6.0	0.9	3.5	01/16	17.6	NW	34.4	01/16	1013.8
46001	56.3N	148.2W	0737	3.2	4.9	4.1	8.5	10/22	18.2	E	36.7	02/18	996.4
46002	42.5N	130.3W	0742	13.1	13.8	4.1	8.7	12/17	17.3	S	43.7	12/15	1010.6
46003	51.9N	155.9W	0739	4.6	5.2	4.0	11.1	07/23	13.4	E	35.2	07/18	990.3
46005	46.1N	131.0W	0736	10.8	11.6	4.1	8.6	14/17	16.8	S	34.0	14/17	1008.7
46006	40.9N	137.5W	0735	13.7	13.9	4.5	8.4	13/23	17.9	SW	40.4	12/03	1009.7
46012	37.4N	122.7W	0742	12.3	12.5	2.8	8.0	13/01	10.1	NW	37.7	12/13	1018.6
46013	38.2N	123.3W	0740	12.2	12.7	2.9	8.8	12/14	11.8	E	36.3	12/11	1020.0
46014	39.2N	124.0W	0742	12.8	13.7	3.3	10.3	13/05	12.2	SE	42.4	12/11	1018.1
46022	40.8N	124.5W	0737	12.9	13.6	3.6	9.5	13/00	13.4	SE	43.3	12/08	1017.9
46023	34.3N	120.7W	0730	13.6	14.4	2.9	7.0	13/23	16.9	NW	31.1	24/18	1018.9
46025	33.8N	119.1W	0738	15.0	16.2	1.5	4.0	13/16	8.4	NW	28.0	23/13	1017.4
46026	37.8N	122.8W	0401	12.6		2.3	7.2	13/03	10.8	NW	34.4	12/09	1019.0
46027	41.9N	124.4W	0738	12.0	12.8	3.2	10.0	12/21	11.7	SE	38.7	12/12	1016.1
46028	35.7N	121.9W	0738	13.3	14.1	2.9	7.7	13/11	12.8	NW	30.3	12/15	1020.2
46029	46.3N	124.3W	0740	8.8	10.0	3.3	7.1	11/08	17.6	E	41.6	12/21	1013.5
46030	40.4N	124.5W	0739	12.7	13.6	3.3	9.4	13/05	13.4	SE	39.4	12/05	1017.8
46035	57.0N	177.7W	0731	2.0	3.8	3.1	7.8	15/08	18.5	NE	37.7	15/03	993.0
46041	47.4N	124.5W	0741	9.3	10.5	3.1	7.2	13/09	15.5	SE	37.7	13/03	1012.6
46042	36.8N	122.4W	0741	13.1	13.1	2.8	7.4	12/20	9.6	NW	33.2	12/14	1019.6
46045	33.8N	118.5W	0737	14.5	16.0	1.1	3.1	14/01	6.7	NE	24.9	16/17	1017.4
46050	44.6N	124.5W	0739	11.2	12.0	3.5	9.2	12/22	15.0	E	44.7	12/18	1014.1
46051	34.5N	120.7W	0738	13.7	14.6	2.8	7.3	13/11	14.8	NW	33.8	24/19	1018.6
46053	34.2N	119.9W	0738	14.7	15.2	1.9	5.6	13/07	10.8	W	30.1	23/09	1017.6
46054	34.3N	120.5W	0743	14.1	14.8	2.9	7.6	13/21	17.3	NW	31.7	24/18	1018.4
46059	38.0N	130.0W	0740	15.8	16.5	3.9	10.9	12/13	14.6	SW	38.7	12/08	1017.4
46060	60.6N	146.8W	1481	1.7	6.3	1.0	3.2	23/19	13.7	E	37.3	23/19	1002.4
46061	60.2N	146.8W	1207	3.9	6.0	2.5	6.3	23/16	16.2	E	42.7	26/00	1000.8
51001	23.4N	162.3W	0741	24.8	25.8	2.9	6.3	25/17	11.9	SW	26.9	30/14	1015.6
51002	17.2N	157.8W	0741	25.8	26.4	2.5	4.3	17/21	14.1	E	27.5	17/13	1014.2
51003	19.1N	160.8W	0743	25.9	26.8	2.4	4.8	26/20	9.7	E	24.7	31/13	1015.4
51004	17.4N	152.5W	0737	25.2	26.1	2.4	4.5	27/01	13.3	E	22.0	17/03	1016.3
51026	21.4N	156.9W	0738	24.8	25.5	2.4	5.0	26/08	8.1	SE	19.0	01/11	1016.9
91204	9.9N	139.7E	0636	28.4					11.0	NE	27.2	24/21	1009.7
91222	18.1N	145.8E	0448	26.2					5.4	NE	13.6	10/04	1013.0
91251	11.4N	162.4E	0732	28.0					16.3	NE	26.3	25/18	1009.9
91328	8.6N	149.7E	0741	28.2					8.0	NE	18.1	23/14	1011.2
91338	5.3N	153.7E	0557	28.0					4.3	NE	21.3	23/19	1009.0
91343	7.6N	155.2E	0741	28.2					11.3	NE	31.0	09/16	1008.6
91352	6.2N	160.7E	0741	28.1					9.0	NE	21.5	08/19	1009.3
91355	5.4N	163.0E	0742	27.5					6.0	E	20.7	19/13	1008.1
91377	6.1N	172.1E	0502	28.0					9.3	NE	23.3	21/12	1011.6
91411	8.3N	137.5E	0579	27.9									1009.0
ABAN6	44.3N	075.9W	0726	-6.0	2.5				3.7	SW	25.3	06/01	1017.3
ALSN6	40.5N	073.8W	0737	1.0	7.6	0.8	2.4	09/21	19.4	NW	41.7	11/06	1016.8
BLIA2	60.8N	146.9W	1479	-0.1					18.7	N	40.4	01/19	1003.5

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SCALAR WAVE HT (DA/HR)	MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KNOTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
BURL1	28.9N	089.4W	0738	14.5					14.4	N	32.7	10/06	1021.1
BUSL1	27.9N	090.9W	0208	15.5					12.9	NE	29.7	22/12	1022.3
CARO3	43.3N	124.4W	0739	10.3					10.8	SE	53.1	12/20	1015.0
CDRF1	29.1N	083.0W	0720	12.7					7.2	NE	19.2	08/09	1020.4
CHLV2	36.9N	075.7W	0740	5.1	9.0	1.2	2.6	17/00	16.0	NW	40.7	20/23	1019.4
CLKN7	34.6N	076.5W	0740	8.2					11.6	NW	28.9	09/10	1019.7
DBLN6	42.5N	079.4W	0739	-2.1					16.4	W	44.4	06/18	1017.9
DESW1	47.7N	124.5W	0741	7.9					15.6	SE	53.6	13/04	1013.1
DISW3	47.1N	090.7W	0740	-5.5					15.6	W	43.0	06/00	1019.5
DPIA1	30.3N	088.1W	0740	11.7					11.4	N	32.3	10/00	1021.2
DRYF1	24.6N	082.9W	0721	21.5	23.9				13.5	NE	29.6	13/00	1018.3
DSLN7	35.2N	075.3W	0569	8.3		0.8	1.4	23/00	18.8	NW	49.3	09/14	1019.4
FBIS1	32.7N	079.9W	0738	9.4					7.7	NE	23.9	18/02	1020.3
FFIA2	57.3N	133.6W	0738	1.9					16.8	N	37.6	06/22	1007.0
FPSN7	33.5N	077.6W	0740	12.3	20.0	1.2	4.0	20/00	15.6	NW	40.7	19/22	1019.5
FWYF1	25.6N	080.1W	0740	20.6	24.4				14.0	NW	34.0	13/07	1018.7
GDIL1	29.3N	090.0W	0738	13.6	15.3				11.5	N	28.7	09/21	1020.8
GLLN6	43.9N	076.5W	0738	6.8					16.2	NW	43.0	10/21	1000.9
IOSN3	43.0N	070.6W	0740	-1.3					17.9	NW	36.7	10/04	1012.6
KTNF1	29.8N	083.6W	0634	11.5					7.2	NE	28.8	20/09	1019.4
LKWF1	26.6N	080.0W	0741	19.3	24.2				10.4	NW	23.7	31/13	1018.7
LONF1	24.9N	080.9W	0578	21.2	22.1				11.6	N	26.8	11/03	1018.0
MDRM1	44.0N	068.1W	0738	-0.7					19.6	NW	51.4	10/06	1010.8
MISM1	43.8N	068.9W	0740	-0.7					19.8	NW	49.8	10/04	1011.7
MLRF1	25.0N	080.4W	0742	21.0	24.8				13.7	E	26.7	13/09	1018.3
NWPO3	44.6N	124.1W	0739	8.7					12.4	E	51.6	12/18	1014.6
PILM4	48.2N	088.4W	0740	-7.3					16.5	NW	46.7	05/23	1019.1
POTA2	61.1N	146.7W	1482	-2.9					25.5	N	44.5	05/04	1003.6
PTAC1	39.0N	123.7W	0741	11.8					9.7	S	43.8	12/11	1019.0
PTAT2	27.8N	097.1W	0731	15.8					11.5	SE	30.8	09/09	1019.2
ROAM4	47.9N	089.3W	0739	-7.6	2.6				17.6	NW	38.9	05/05	1018.3
SANF1	24.5N	081.9W	0742	21.2	24.3				14.5	NE	30.7	13/05	1017.8
SAUF1	29.9N	081.3W	0738	13.1	16.4				8.5	NW	28.4	07/22	1020.4
SBIO1	41.6N	082.8W	0738	-2.9					14.9	W	40.6	06/02	1020.0
SGNW3	43.8N	087.7W	0725	-6.1					12.4	W	34.3	05/19	1021.9
SISW1	48.3N	122.9W	0739	6.5					14.1	SE	43.5	04/10	1014.3
SMKF1	24.6N	081.1W	0743	21.0	24.4				15.0	N	33.2	13/08	1018.6
SPGF1	26.7N	079.0W	0725	21.0	24.3				9.0	E	22.8	20/14	1018.8
SRST2	29.7N	094.1W	0739	12.3					9.5	NE	23.8	09/18	1020.1
STDM4	47.2N	087.2W	0739	-4.7					20.6	W	52.6	05/22	1017.2
SUPN6	44.5N	075.8W	0723	-6.2	2.2				9.4	SW	32.0	06/08	1018.2
SVLS1	32.0N	080.7W	0740		14.0	0.7	2.2	08/09	12.2	NE	29.2	17/23	1020.1
THIN6	44.3N	076.0W	0729	-5.8									
TPLM2	38.9N	076.4W	0739	1.6	4.1				11.0	NW	26.6	01/08	1019.5
TTIW1	48.4N	124.7W	0743	7.3					20.3	E	48.4	11/11	1012.7
VENF1	27.1N	082.5W	0741	16.1	18.7				8.4	NE	27.2	20/11	1019.9
WPOW1	47.7N	122.4W	0737	7.0					10.0	S	47.2	13/03	1015.6
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41001	34.7N	072.6W	0713	18.2		2.3	5.7	08/05	16.2	NW	38.9	08/04	1017.3
41002	32.4N	075.3W	0715	19.2	23.5	1.0	2.6	15/11	13.6	S	30.9	15/10	1018.1
41004	32.5N	079.1W	0709	17.0	23.2	1.2	3.9	12/01	13.0	N	33.6	11/23	1019.6
41006	29.3N	077.3W	0711	22.2	25.1	1.7	3.6	12/16	12.8	N	26.4	14/19	1017.3
41009	28.5N	080.2W	1428	22.0	25.2	1.2	2.5	12/11	14.4	NW	18.5	29/18	1018.6
41010	28.9N	078.5W	1427	22.3	25.5	1.6	3.4	15/15	12.1	N	26.2	08/10	1018.1
41018	15.0N	075.0W	0714	28.2	28.5	1.6	2.8	24/09	14.6	E	23.3	17/02	1011.9
41021	31.9N	080.9W	0714	14.3	16.8	0.5	1.6	11/20	10.1	NE	25.5	12/01	1020.4
41022	31.9N	080.9W	0708	14.9	17.2	0.7	1.5	05/15	10.6	S	28.2	11/20	1020.4
42001	25.9N	089.7W	0708	23.7	26.5	1.3	2.9	04/12	13.0	SE	29.9	24/14	1018.2
42002	25.9N	093.6W	0712	23.7	25.6	1.4	4.5	11/23	14.1	SE	30.1	11/17	1017.7
42003	25.9N	085.9W	0707	23.5	27.4	1.2	3.3	12/11	13.9	NE	30.3	24/19	1017.6
42007	30.1N	088.8W	0715	16.4	19.1				13.1	N	30.9	04/03	1019.9
42019	27.9N	095.0W	0713	21.6	24.3	1.5	4.0	11/15	14.1	NE	32.3	11/13	1020.9
42020	27.0N	096.5W	0712	22.3		1.6	4.8	11/15	14.2	S	34.0	11/14	1017.9
42035	29.3N	094.4W	0522	19.0	20.2	1.0	2.6	27/12	12.2	S	29.9	11/13	1018.9
42036	28.5N	084.5W	0710	20.9	24.1	1.0	3.7	12/05	12.5	N	27.6	12/04	1020.1
42037	24.5N	081.4W	0715	23.9	26.5	0.8	2.0	01/08	10.7	E	18.5	14/13	1017.9
44004	38.5N	070.7W	0710	14.0	18.6	2.5	8.1	12/09	15.7	NW	35.2	12/07	1016.5
44005	42.9N	069.0W	0653	6.8	10.0	2.0	6.7	12/19	15.6	NW	36.1	14/23	1015.7
44007	43.5N	070.2W	0714	4.8	9.2	1.4	7.3	15/09	13.1	N	36.3	15/04	1014.9
44008	40.5N	069.4W	0706		12.8	2.4	7.9	12/12	15.0	NW	31.5	12/13	1015.8
44009	38.5N	074.7W	0239	8.2	12.8	1.5	2.7	27/23	16.3	N	26.2	29/10	1015.4
44011	41.1N	066.6W	0712	10.1	11.5	2.6	6.2	15/16	14.8	W	34.4	26/13	1016.0
44013	42.4N	070.7W	0701	6.4	8.8	1.2	6.4	15/02	13.7	W	35.4	14/22	1015.4
44014	36.6N	074.8W	0714	13.0	17.4	1.6	6.3	12/02	15.2	NW	40.0	12/01	1017.6
44025	40.3N	073.2W	0262	11.0	14.6	1.3	3.4	12/00	14.6	S	30.5	08/11	1017.4
44028	41.4N	071.1W	0712	15.9	12.1	1.2	4.9	12/08	16.7	NW	41.2	14/20	1015.8
45002	45.3N	086.4W	0282	2.8	9.7	1.8	4.6	10/09	21.1	NW	33.2	11/13	1010.9
45003	45.3N	082.8W	0678	1.0	6.5	1.6	4.4	12/01	18.6	NW	36.7	11/21	1012.8
45005	41.7N	082.4W	0496	4.1	7.9	0.8	2.6	11/22	16.2	W	32.1	12/00	1015.9
45007	42.7N	087.0W	0296	2.8	8.0	1.6	5.2	11/10	18.6	W	35.2	11/12	1014.4
45008	44.3N	082.4W	0013	6.2	9.6	0.9	1.4	01/11	15.4	E	18.5	01/09	1023.8
45010	43.0N	087.8W	0301	1.5	5.6	1.0	3.3	11/09	15.8	W	31.9	11/06	1014.2
46001	56.3N	148.2W	0712	4.5	6.6	2.9	8.8	10/20	15.8	NW	42.2	03/20	1001.8
46002	42.5N	130.3W	0715	14.9	15.6	3.1	6.1	12/00	16.2	SW	32.3	17/17	1016.1
46003	51.9N	155.9W	0712	4.6	6.0	3.1	7.5	29/01	13.6	NW	37.1	10/04	1003.4
46005	46.1N	131.0W	0712	12.6	13.4	3.6	8.9	11/18	16.7	SW	33.4	17/21	1013.3
46006	40.9N	137.5W	0695	15.4	16.1	3.4	6.0	15/00	16.3	SW	27.6	24/16	1015.9
46011	34.9N	120.9W	0664	14.5	15.4	1.9	3.8	24/13	9.9	NW	22.7	28/23	1017.4

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SCALAR WAVE HT (DA/HR)	MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KNOTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46012	37.4N	122.7W	0713	12.5	12.8	1.9	3.7	10/10	9.2	NW	22.5	10/08	1018.8
46013	38.2N	123.3W	0712	12.2	12.6	2.0	3.7	12/17	9.9	NW	29.5	10/07	1020.7
46014	39.2N	124.0W	0713	12.7	13.5	2.2	5.4	06/01	8.3	NW	23.5	21/03	1020.0
46022	40.8N	124.5W	0705	12.5	12.4	2.4	5.8	06/02	9.0	S	33.2	17/23	1021.2
46023	34.3N	120.7W	0711	14.9	15.8	2.1	4.0	27/01	13.1	NW	31.3	27/07	1017.6
46025	33.8N	119.1W	0712	15.8	17.0	0.8	2.3	27/17	4.6	W	26.0	27/16	1016.8
46026	37.8N	122.8W	0714	12.6		1.7	3.2	18/17	8.7	NW	25.3	10/06	1019.9
46027	41.9N	124.4W	0709	11.8	11.6	2.3	4.3	06/05	9.4	SE	27.8	17/23	1019.5
46028	35.7N	121.9W	0710	13.7	14.5	2.1	4.3	06/11	12.4	NW	29.1	26/18	1019.3
46029	46.3N	124.3W	0706	11.3	11.1	2.8	6.3	12/01	14.4	S	38.7	18/01	1015.8
46030	40.4N	124.5W	0711	12.1	12.0	2.2	5.0	06/07	9.7	N	28.8	17/22	1020.8
46035	57.0N	177.7W	0708	2.6	4.5	2.5	8.5	20/02	14.4	N	41.6	20/01	1016.8
46041	47.4N	124.5W	0244	11.7	11.3	2.9	4.7	23/18	14.8	SE	29.9	23/16	1012.0
46042	36.8N	122.4W	0711	13.3	13.5	1.9	3.7	12/23	7.9	NW	18.3	07/01	1019.3
46045	33.8N	118.5W	0714	15.8	17.4	0.7	1.6	27/07	4.2	SW	12.2	03/23	1016.7
46050	44.6N	124.5W	0712	12.0		2.9	7.2	05/16	13.7	S	37.3	17/23	1017.2
46051	34.5N	120.7W	0708	15.0	16.1	2.0	3.6	27/00	11.6	NW	25.1	26/23	1017.4
46053	34.2N	119.9W	0715	15.9	17.1	1.1	2.4	25/17	5.1	W	18.3	06/06	1016.9
46054	34.3N	120.5W	0717	15.5	16.3	1.9	3.9	27/00	11.5	NW	33.8	27/13	1017.3
46059	38.0N	130.0W	0714	16.7	16.9	2.6	5.5	06/00	11.3	SW	27.4	21/01	1021.2
46060	60.6N	146.8W	1412	3.9	8.0	0.8	2.6	01/06	10.8	N	37.5	01/06	1003.7
51001	23.4N	162.3W	0715	24.8	25.7	2.5	6.3	23/08	11.6	NE	25.3	26/10	1014.9
51002	17.2N	157.8W	0713	26.4	26.9	2.2	3.9	23/21	15.1	E	22.1	04/05	1012.1
51003	19.1N	160.8W	0715	26.4	27.0	2.3	5.9	23/18	12.0	E	27.7	04/17	1013.8
51004	17.4N	152.5W	0711	25.5	26.5	2.3	5.0	23/22	14.2	E	22.2	09/21	1014.7
51026	21.4N	156.9W	0711	24.9	25.6	2.3	7.3	23/19	13.3	E	24.1	04/18	1015.9
51027	20.5N	157.1W	0586	25.8	26.7	1.4	2.8	04/19	10.1	E	27.8	04/19	1014.7
91204	9.5N	139.4E	0564	28.3					9.6	NE	25.2	07/11	1009.2
91222	18.1N	145.8E	0593	27.6					4.5	E	15.9	06/01	1011.4
91251	11.4N	162.4E	0709	28.1					14.1	NE	25.4	24/08	1008.9
91328	8.6N	149.7E	0712	28.3					6.0	NE	15.8	17/08	1010.4
91338	5.3N	153.7E	0582	28.6					5.1	NE	29.1	08/08	1008.3
91343	7.6N	155.2E	0714	28.2					7.8	NE	29.6	20/17	1008.0
91352	6.2N	160.7E	0702	28.0					5.9	E	26.5	20/07	1010.1
91355	5.4N	163.0E	0714	27.1					5.6	E	20.3	14/16	1007.7
91377	6.1N	172.1E	0494	27.8					7.3	NE	19.4	17/14	1011.1
91411	8.3N	137.5E	0561	28.2									1008.5
ABAN6	44.3N	075.9W	0715	1.0	7.8				5.3	SW	27.2	15/07	1015.0
ALSN6	40.5N	073.8W	0714	7.3	12.4	1.0	4.7	12/05	17.5	W	51.8	12/03	1016.9
BLIA2	60.8N	146.9W	1420	2.5					20.7	N	39.5	04/16	1004.6
BURL1	28.9N	089.4W	0714	18.4					13.9	NE	33.3	03/07	1020.7
BUSL1	27.9N	090.9W	0423	22.7					12.3	S	27.9	11/16	1019.7
CARO3	43.3N	124.4W	0711	11.6					12.9	S	33.5	18/02	1018.3
CDRF1	29.1N	083.0W	0715	16.1					7.1	N	18.4	10/02	1020.1
CHLV2	36.9N	075.7W	0713	10.4	15.6	1.2	3.8	12/03	16.7	N	46.1	12/02	1018.6
CLKN7	34.6N	076.5W	0715	12.9					11.8	N	34.6	12/04	1019.1
DBLN6	42.5N	079.4W	0715	3.6					14.2	S	46.6	28/10	1014.8
DESW1	47.7N	124.5W	0713	10.1					16.0	SE	35.5	18/03	1014.6
DISW3	47.1N	090.7W	0715	-2.5					14.4	NW	35.1	20/23	1015.4
DPIA1	30.3N	088.1W	0710	15.7					11.7	N	29.9	04/05	1020.8
DRYF1	24.6N	082.9W	0714	24.0	26.0				13.7	NE	25.3	21/16	1017.9
DSLN7	35.2N	075.3W	0236	14.9					20.2	N	64.0	12/00	1018.1
FBIS1	32.7N	079.9W	0714	13.5					7.7	NE	30.9	11/21	1019.9
FFIA2	57.3N	133.6W	0711	3.7					16.8	N	36.8	27/16	1005.9
FPSN7	33.5N	077.6W	0714	15.8	21.3	1.3	4.6	12/02	16.2	N	51.7	12/02	1018.9
FWYF1	25.6N	080.1W	0713	23.8	26.1				14.4	NE	31.1	29/12	1018.1
GDIL1	29.3N	090.0W	0716	17.5	18.9				11.4	NE	27.7	11/16	1020.4
GLLN6	43.9N	076.5W	0713	3.1					17.6	W	41.3	12/12	1014.9
IOSN3	43.0N	070.6W	0713	5.1					15.7	W	49.4	15/04	1015.3
KTNF1	29.8N	083.6W	0713	14.4					6.8	NE	20.6	11/23	1020.0
LKWF1	26.6N	080.0W	0709	23.1	25.4				11.7	SE	22.7	25/22	1018.9
LONF1	24.9N	080.9W	0715	23.0	23.6				11.6	NE	23.7	09/08	1017.7
MDRM1	44.0N	068.1W	0710	5.3					18.2	NW	44.7	12/14	1015.4
MISM1	43.8N	068.9W	0711	5.1					18.5	W	54.4	12/13	1015.6
MLRF1	25.0N	080.4W	0713	24.0	26.4				13.9	E	24.7	29/08	1017.7
NWPO3	44.6N	124.1W	0712	11.3					13.1	S	42.3	29/18	1017.3
PILM4	48.2N	088.4W	0702	-3.8					16.1	NW	36.3	23/05	1014.6
POTA2	61.1N	146.7W	1427	0.5					23.8	N	43.7	30/21	1004.9
PTAC1	39.0N	123.7W	0710	11.7					7.5	N	31.3	21/05	1020.4
PTAT2	27.8N	097.1W	0709	18.6					11.8	N	37.1	11/12	1019.0
ROAM4	47.9N	089.3W	0710	-3.8	5.2				16.8	NW	36.1	23/05	1014.5
SANF1	24.5N	081.9W	0714	23.8	26.2				15.1	NE	26.2	25/04	1017.3
SAUF1	29.9N	081.3W	0715	17.1	20.4				8.6	NW	21.1	30/21	1020.1
SBIO1	41.6N	082.8W	0716	3.0					16.7	S	44.4	11/22	1016.4
SGNW3	43.8N	087.7W	0673	8.6					12.5	NW	36.3	09/21	1015.7
SISW1	48.3N	122.9W	0709	9.2					12.5	SE	44.7	18/08	1014.4
SMKF1	24.6N	081.1W	0714	23.8	26.4				14.8	NE	26.3	01/00	1018.0
SPGF1	26.7N	079.0W	0713	23.3	25.7				7.8	E	20.7	10/22	1018.5
SRST2	29.7N	094.1W	0714	16.3					9.7	NE	23.5	11/10	1019.7
STDM4	47.2N	087.2W	0715	-1.9					18.8	NW	37.7	03/09	1013.6
SUPN6	44.5N	075.8W	0706	0.7	7.8				11.5	SW	31.5	11/17	1016.1
SVLS1	32.0N	080.7W	0708		18.2	0.7	2.4	11/23	12.8	NE	35.7	12/02	1019.8
THIN6	44.3N	076.0W	0704	1.0									
TPLM2	38.9N	076.4W	0711	7.1	10.1				13.3	S	43.0	12/00	1018.1
TTIW1	48.4N	124.7W	0717	9.8					19.4	E	61.9	18/04	1014.0
VENF1	27.1N	082.5W	0712	19.1	22.2				8.4	NE	23.1	12/05	1019.7
WPOW1	47.7N	122.4W	0710	10.2					13.6	S	36.7	18/08	1015.8

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SCALAR WAVE HT (DA/HR)	MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KNOTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
October 1995													
41001	34.7N	072.6W	0738	23.3		1.9	5.0	15/18	12.7	S	28.2	15/18	1017.2
41002	32.3N	075.2W	0238	24.0	25.9	1.2	2.0	01/02	11.8	E	24.1	21/11	1016.4
41004	32.5N	079.1W	0739	23.7	25.7	1.5	3.8	05/12	13.7	NE	29.0	11/20	1016.2
41006	29.3N	077.3W	0740	26.2	27.1	1.9	4.0	15/16	14.3	NE	31.1	15/13	1014.0
41009	28.5N	080.2W	1484	26.4	27.3	1.4	3.2	17/23	13.1	E	30.1	15/08	1014.0
41010	28.9N	078.5W	1481	26.3	27.6	1.8	3.7	15/13	14.1	SE	27.2	15/09	1014.1
41018	15.0N	075.0W	0742	28.3	29.1	1.2	2.6	06/04	11.7	E	22.0	13/16	1010.2
41021	31.9N	080.9W	0740	22.8	23.0	0.8	2.1	05/09	12.2	NE	25.8	05/09	1016.3
41022	31.9N	080.9W	0740	22.6	23.7				12.9	NE	28.4	05/06	1016.4
42001	25.9N	089.7W	0736	26.4	27.9	2.0	8.3	04/04	17.4	E	51.5	04/09	1011.8
42002	25.9N	093.6W	0736	26.0	27.6	2.0	6.1	15/04	17.1	NE	39.6	14/12	1012.4
42003	25.9N	085.9W	0736	26.7	27.9	1.7	6.9	04/13	15.6	E	41.8	04/08	1011.4
42007	30.1N	088.8W	0742	22.4	24.4				15.3	NE	51.5	04/18	1014.7
42019	27.9N	095.0W	0742	24.9	26.7	1.7	4.5	30/22	14.6	NE	30.7	14/21	
42020	27.0N	096.5W	0738	25.7		2.0	4.5	29/08	13.9	NE	32.8	29/03	1013.7
42035	29.3N	094.4W	0637	23.5	25.0	1.0	2.4	29/23	12.7	E	31.5	03/07	1014.9
42036	28.5N	084.5W	0733	26.1	27.1	1.4	8.6	04/18	14.6	NE	34.2	04/17	1014.4
42037	24.5N	081.4W	0739	27.4	28.5	0.9	3.0	05/05	10.7	E	23.1	14/07	1012.7
44004	38.5N	070.7W	0739	20.6	24.0	2.0	6.1	15/10	13.7	NW	30.9	28/14	1017.3
44005	42.9N	069.0W	0734	13.2	13.2	1.6	4.4	16/11	12.9	SW	32.4	06/13	1015.7
44007	43.5N	070.2W	0738	12.0	12.2	1.1	4.3	22/04	9.7	S	29.5	06/15	1014.3
44008	40.5N	069.4W	0728		16.8	1.7	5.3	21/17	11.7	W	29.5	30/12	1016.5
44011	41.1N	066.6W	0737	15.1	14.4	2.0	5.6	15/23	10.8	W	28.6	16/20	1016.7
44013	42.4N	070.7W	0736	13.5		0.8	3.3	06/09	11.5	SW	30.7	21/23	1015.4
44014	36.6N	074.8W	0740	20.4	21.3	1.5	3.5	21/12	11.9	N	28.0	28/12	1017.3
44025	40.3N	073.2W	0731	16.5	17.4	1.3	3.9	22/02	13.2	W	31.1	29/22	1016.2
44028	41.4N	071.1W	0728	16.6	16.8	1.0	3.1	21/21	14.4	SW	32.8	15/04	1016.0
45001	48.1N	087.8W	0659	7.3	7.6	1.3	5.8	21/05	15.6	NE	37.5	21/06	1007.5
45002	45.3N	086.4W	0736	10.4	12.6	1.2	5.3	17/19	16.4	S	35.6	17/16	1009.0
45003	45.3N	082.8W	0740	10.0	10.6	1.3	4.2	15/21	15.9	S	32.6	15/23	1009.9
45004	47.6N	086.5W	0682	8.1	8.5	1.3	4.6	15/13	15.0	NW	32.1	15/15	1008.1
45005	41.7N	082.4W	0742	13.8	15.4	0.8	3.7	05/22	14.2	S	33.2	05/19	1013.5
45006	47.3N	089.9W	0693	8.6	9.1	1.3	4.9	21/11	12.8	NE	30.7	24/04	1008.7
45007	42.7N	087.0W	0742	11.7	12.8	1.0	3.3	24/09	14.5	W	31.3	24/14	1011.7
45008	44.3N	082.4W	0742	11.5	12.6	1.2	3.2	15/23	15.8	S	29.3	18/00	1010.9
45010	43.0N	087.8W	0737	10.9	11.0	0.5	2.1	05/16	11.5	W	24.9	14/21	1011.3
46001	56.3N	148.2W	0740	8.1	9.5	3.3	9.0	01/19	16.8	W	34.4	22/04	999.5
46002	42.5N	130.3W	0744	15.9	17.1	2.7	5.4	21/19	11.0	NW	26.8	11/12	1020.0
46003	51.9N	155.9W	0738	7.5	7.9	3.7	10.3	01/09	16.7	W	36.5	19/15	1004.0
46005	46.1N	131.0W	0739	14.2	15.4	3.2	6.2	21/03	15.6	W	28.8	17/04	1018.5
46006	40.9N	137.5W	0740	16.8	17.6	2.6	5.7	21/09	12.8	SW	26.4	30/12	1021.2
46011	34.9N	120.9W	0738	15.0	15.6	2.0	4.0	22/17	8.1	NW	24.5	17/02	1013.5
46012	37.4N	122.7W	0741	13.6	13.6	2.0	4.4	22/05	9.0	NW	28.0	04/02	1014.5
46013	38.2N	123.3W	0739	12.8	12.5	2.2	4.7	22/00	11.4	NW	31.1	21/22	1016.1
46014	39.2N	124.0W	0740	12.8	12.5	2.5	5.2	22/00	9.9	NW	29.0	21/22	1015.9
46022	40.8N	124.5W	0736	13.0	12.5	2.4	5.3	22/00	9.5	N	27.6	21/22	1018.5
46023	34.3N	120.7W	0741	15.8	16.6	2.1	4.0	22/14	10.9	NW	27.2	17/02	1013.6
46025	33.8N	119.1W	0738	17.8	19.1	0.7	1.7	16/04	5.0	W	18.5	16/03	1013.0
46026	37.8N	122.8W	0732	13.7		1.7	3.8	22/02	9.0	NW	25.1	12/02	1015.5
46027	41.9N	124.4W	0740	12.2	11.4	2.3	4.5	22/17	10.5	NW	27.6	01/23	1017.2
46028	35.7N	121.9W	0738	14.3	14.4	2.3	4.9	22/10	10.9	NW	29.1	04/02	1015.2
46029	46.3N	124.3W	0738	13.3	14.0	2.5	5.3	21/16	10.1	S	33.4	25/22	1018.8
46030	40.4N	124.5W	0739	11.9	11.0	2.3	5.2	22/05	10.2	N	25.1	21/23	1017.9
46035	57.0N	177.7W	0744	4.9	6.9	2.8	8.7	30/06	18.4	NW	44.3	30/00	1004.4
46042	36.8N	122.4W	0738	14.3	14.6	2.3	4.9	22/07	7.0	NW	21.0	13/01	1015.0
46045	33.8N	118.5W	0741	17.9	19.1	0.6	1.4	16/02	5.0	W	17.7	16/01	1012.9
46050	44.6N	124.5W	0740		14.8	2.5	5.0	21/21	10.3	N	26.4	25/20	1019.1
46051	34.5N	120.7W	0341	15.1	15.7	1.9	4.2	22/13	9.1	NW	24.3	25/21	1014.2
46053	34.2N	119.9W	0728	17.2	18.4	1.0	1.8	13/11	6.4	W	22.7	16/01	1013.0
46054	34.3N	120.5W	0742	16.4	17.1	1.9	3.7	22/22	10.2	NW	29.0	16/23	1013.4
46059	38.0N	130.0W	0742	17.7	18.6	2.4	4.9	22/05	12.4	N	21.6	04/03	1021.6
46060	60.6N	146.8W	1484	7.6	9.6	0.7	2.4	24/22	12.7	E	34.0	01/16	1001.5
51001	23.4N	162.3W	0739	25.7	26.6	2.2	3.6	09/08	14.8	E	26.7	09/03	1016.9
51002	17.2N	157.8W	0738	26.4	26.9	2.2	3.2	21/03	16.4	E	23.7	11/21	1012.5
51003	19.1N	160.8W	0740	26.8	27.6	2.0	2.9	11/03	12.3	E	20.9	01/02	1014.2
51004	17.4N	152.5W	0739	26.0	27.0	2.2	3.1	12/08	14.9	NE	21.3	20/02	1014.4
51026	21.4N	156.9W	0736	25.2	26.0	2.0	3.4	30/10	15.6	E	21.8	08/05	1016.4
51027	20.5N	157.1W	0736	26.0	26.8	1.7	2.6	08/23	15.2	SE	25.8	21/05	1014.7
91222	18.1N	145.8E	0602	28.1					6.0	E	17.2	29/03	1009.3
91251	11.4N	162.4E	0731	28.0					11.6	E	39.8	01/01	1008.6
91328	8.6N	149.7E	0738	28.1					4.9	NE	22.0	11/22	1010.2
91338	5.3N	153.7E	0511	28.3					4.2	E	19.4	27/16	1008.5
91343	7.6N	155.2E	0743	28.1					5.3	E	16.7	26/17	1008.0
91352	6.2N	160.7E	0726	28.0					5.7	E	21.6	15/02	1011.4
91355	5.4N	163.0E	0740	27.3					5.1	E	17.9	02/20	1008.0
91377	6.1N	172.1E	0476	28.2					7.9	E	21.4	20/13	1011.4
ABAN6	44.3N	075.9W	0690	11.7	14.0				4.8	S	18.1	24/16	1011.6
ALSN6	40.5N	073.8W	0742	16.3	18.0	1.0	3.0	21/17	15.9	W	40.2	21/16	1016.6
BLIA2	60.8N	146.9W	1482	6.3					9.0	N	26.5	19/14	1002.4
BURL1	28.9N	089.4W	0736	23.7					15.9	NE	63.6	04/17	1015.4
BUSL1	27.9N	090.9W	0581	25.5					16.7	E	44.4	04/08	1008.7
CARO3	43.3N	124.4W	0735	12.6					9.5	N	34.3	15/19	1018.8
CDRF1	29.1N	083.0W	0742	23.4					9.4	NE	31.9	04/23	1014.7
CHLV2	36.9N	075.7W	0741	19.3	21.5	1.0	2.4	21/12	13.5	S	32.5	06/00	1017.8
CLKN7	34.6N	076.5W	0738	21.5					11.2	NE	25.9	29/03	1017.4
CSBF1	29.7N	085.4W	0091	25.6					9.2	NE	39.5	04/20	1009.7
DBLN6	42.5N	079.4W	0735	13.6					12.4	SW	40.2	24/22	1013.6
DESW1	47.7N	124.5W	0739	11.9					10.6	SE	40.9	25/22	1018.2
DISW3	47.1N	090.7W	0736	8.6					15.5	NW	45.3	24/02	1010.1
DPIA1	30.3N	088.1W	0742	21.7					13.0	N	52.6	04/22	1015.6

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SCALAR WAVE HT (DA/HR)	MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KNOTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
DRYF1	24.6N	082.9W	0736	27.6	28.8				12.1	E	27.8	04/15	1012.3
DSLN7	35.2N	075.3W	0450	23.5		1.8	2.9	06/02	17.5	NE	41.3	21/09	1016.5
FBIS1	32.7N	079.9W	0738	21.7					10.2	NE	29.1	05/12	1016.5
FFIA2	57.3N	133.6W	0741	8.4					12.3	SE	35.0	19/15	1007.1
FPSN7	33.5N	077.6W	0739	23.0	25.5	1.5	3.4	05/21	16.0	NE	40.8	20/22	1016.7
FWYF1	25.6N	080.1W	0740	27.4	28.2				14.3	SE	34.0	15/01	1013.3
GDIL1	29.3N	090.0W	0737	22.9	23.9				12.9	NE	39.9	04/14	1015.3
GLLN6	43.9N	076.5W	0740	12.5					16.3	W	39.6	15/19	1013.4
IOSN3	43.0N	070.6W	0736	12.8					13.9	W	39.5	22/03	1014.9
KTNF1	29.8N	083.6W	0741	22.3					8.5	NE	29.8	04/23	1014.8
LKWF1	26.6N	080.0W	0731	26.9	27.9				12.3	SE	31.1	04/12	1014.5
LONF1	24.9N	080.9W	0737	27.5	28.4				11.9	E	26.5	14/17	1012.8
MDRM1	44.0N	068.1W	0742	11.6					15.1	SW	38.0	22/07	1014.9
MISM1	43.8N	068.9W	0736	11.5					15.3	SW	42.6	22/05	1015.0
MLRF1	25.0N	080.4W	0742	27.6	28.7				13.2	E	30.2	14/19	1012.9
NWPO3	44.6N	124.1W	0740	12.1					8.2	E	34.8	26/01	1018.8
PILM4	48.2N	088.4W	0731	6.9					15.6	N	40.2	19/17	1009.4
POTA2	61.1N	146.7W	1482	5.2					13.7	N	30.7	16/17	1002.2
PTAC1	39.0N	123.7W	0736	12.1					9.1	N	25.8	21/21	1016.2
PTAT2	27.8N	097.1W	0738	24.1					13.1	NE	37.3	29/04	1014.8
PTGC1	34.6N	120.7W	0455	15.9					11.3	N	27.6	16/16	1014.2
ROAM4	47.9N	089.3W	0732	6.9	7.8				17.3	N	48.0	21/09	1009.3
SANF1	24.5N	081.9W	0742	27.4	28.7				13.0	E	29.7	04/11	1012.0
SAUF1	29.9N	081.3W	0737	24.5	25.7				11.3	E	28.1	05/00	1015.3
SBIO1	41.6N	082.8W	0741	13.5					15.0	S	34.7	15/23	1013.8
SGNW3	43.8N	087.7W	0739	11.6					11.5	W	30.7	17/16	1012.1
SISW1	48.3N	122.9W	0742	10.6					9.9	SE	40.3	25/22	1018.1
SMKF1	24.6N	081.1W	0739	27.7	28.7				14.2	E	32.3	14/16	1012.9
SPGF1	26.7N	079.0W	0742	27.0	28.9				7.3	E	19.8	31/00	1013.9
SRST2	29.7N	094.1W	0740	21.2					9.6	NE	30.6	30/16	1015.5
STDM4	47.2N	087.2W	0741	8.0					18.8	NW	44.8	21/05	1008.7
SUPN6	44.5N	075.8W	0740	11.9	14.2				11.4	SW	33.3	15/18	1014.7
SVLS1	32.0N	080.7W	0739	23.8		1.1	2.4	05/07	14.8	NE	30.4	21/07	1015.9
THIN6	44.3N	076.0W	0742	11.7									
TPLM2	38.9N	076.4W	0731	17.1	19.3				10.8	S	29.9	21/07	1016.9
TTIW1	48.4N	124.7W	0741	11.4					13.8	E	45.7	25/22	1018.0
VENF1	27.1N	082.5W	0740	24.9	27.9				8.7	NE	33.6	04/16	1013.9
WPOW1	47.7N	122.4W	0739	11.5					9.1	S	28.5	25/21	1019.1

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